# Economic Development of the Mekong Delta in Vietnam

**Robert Lensink**
**Mai Van Nam**
**(Editors)**

**CDS Research Paper No. 27**
**December 2008**

# Content

# INTRODUCTION

Robert Lensink and Mai van Nam

This book originates from the NPT/VNM project "enhancing the teaching and research capacity to assist small- and medium-sized enterprises and farm households in the Mekong Delta". The project aims to assist the School of Economics and Business Administration (SEBA) of Can Tho University (CTU) in Vietnam in contributing more effectively to the development of the Mekong Delta, particularly in order to increase the overall economic productivity of Small and Medium-Sized Enterprises (SME) and farm households, while taking into consideration the conservation of natural resources and limiting pollution. One of the main activities in the project is to stimulate new research that can contribute to the development of the Mekong Delta economy. The Mekong Delta is confronted with conflicting demands: on the one hand the demand for economic growth, on the other a sustainable use of natural resources. The nine chapters presented in this book aim to improve our understanding of the Mekong River Delta economy in general, and to clarify the conflict between economic development on the one hand, and possible environmental consequences of development, on the other hand. More in particular, this book gives a state of the art overview of the current economic situation in the Mekong Delta, and provides a challenging contribution to the discussion on the importance of SME and farm households in the Mekong Delta. The book also presents new evidence on marketing channels, and natural resource degradation and environmental impacts on forest, land and water resource utilization. The research output thus covers a wide range of subjects, related to environment, SME performance, marketing, and farming households in the Mekong Delta in Vietnam.

The chapters are written by different research groups from SEBA. One of the special features of this book is that the different research groups have carefully developed new datasets, sometimes based on secondary data, but very often obtained by new surveys in the Mekong Delta region. The book thus gives a wealth of new information, based on new primary data, on the economic situation of the Mekong Delta in general, and on farming, marketing, and environmental issues in particular. Preliminary versions of the articles have been presented at several conferences and meetings both at the University of Groningen, the Netherlands, and Can Tho University, Vietnam.

The book starts with three survey chapters on the main subjects of the research project. Phan Dinh Khoi, Truong Dong Loc and Vo Thanh Danh give an overview of the importance of private enterprises in the Mekong Delta. The chapter argues that private enterprises become more and more important. Their contribution to the regional output has increased considerably during the last years, and is now even more important than that of state-owned enterprises. Nguyen Huu Dang and Vo Thanh Danh give an overview of the development of the agricultural sector in the Mekong Delta. This chapter shows that the growth rate of the agricultural sector in the Mekong Delta is on average higher than that of the national level. It also shows that the contribution of the agricultural sector to regional GDP is still very high. Yet, the chapter questions the future role of the agricultural sector as a leading sector in the Mekong Delta. The chapter also draws attention to the environmental impacts of agricultural development. Ngo Thus Thanh Truc, Bui Van Trinh, and Vo Thanh Danh further analyze the environmental consequences of agricultural development. They present an overview of environmental issues important for the Mekong Delta. The chapter reviews the environmental impacts of forest, land and water resource utilization as well as the application of agro-chemicals. It is shown that the forest area in the Mekong Delta, in percentages of the total area, is the lowest in Vietnam. Moreover, the remaining forest area is threatened by forest fire, agricultural development and poor institutional management.

The next three chapters focus on marketing. These studies use a common methodology to examine marketing structure and marketing channels of different products in the Mekong Delta. The different chapters on marketing use the so-called market structure, conduct and performance (SCP) approach. This model assumes that there is a simultaneous relationship between market structure, conduct and performance. The methodology allows to identify in detail the different aspects that are relevant for the problem at hand. In particular, the methodology allows to analyze in detail the behavior of the different actors/intermediaries involved in the market. Thai van Dai, Luu Tien Thuan, and Luu Thanh Duc Hai study the case of Pangasius in the Mekong Delta. The chapter sets out the key players in the Pangasius marketing channels. It is e.g. shown that the Pangasius market is characterized by a high level of competition. Yet, there are high entrance and exit barriers in the Pangasius industry, which is in contrast to the entrance and exit barriers of fisherman which are rather low. Luu Tien Thuan and Luu Thanh Duc Hai analyze the swine market in the Mekong Delta. The marketing channel of swine contains five key players: swine breeders, collectors, slaughter-houses, retailers and consumers. By using newly collected data the chapter analyzes in detail the importance of the different actors in the swine marketing channel. The study shows that the production of swine has increased considerably in the last years. It also shows that collectors get the highest profit margin in the swine marketing

channel, followed by swine breeders, retailers, and finally slaughter houses. The study points out that the swine marketing channel is severely hampered by a shortage of market information and a underdeveloped transportation system. Finally, Nguyen Pham Thanh Nam, Truong Chi Tien, and Luu Thanh Duc Hai analyze the marketing channel of oranges in the Mekong Delta. Vietnam is becoming one of the main fruit exporting countries in the World. Since profit margins in this industry are relatively high, several farmers in the Mekong Delta started to grow crops instead of rice. However, the development of the Vietnamese fruit sector appears to be unstable and unsustainable. This chapter presents an in depth analysis of the marketing channels of oranges, being one of the main fruit products, in the Mekong Delta. The study convincingly argues that fruit from the Mekong Delta is of lower quality than comparable fruit from abroad, and also compared to the rest of Vietnam. Therefore, the chapter calls for an upgrade in the quality of fruit. The study also draws attention to the importance of improving market information in the fruit industry, and the relevance of more education on modern farming methods.

The last three chapters focus on more detailed aspects of farming in the Mekong Delta. Nguyen Van Ngan, Le Khuong Ninh and Robert Lensink determine the characteristics of access to formal credit in the Mekong Delta. Using a newly developed dataset based on a survey in the Mekong Delta, the authors explore why some households have access to formal credit and others not. Moreover, for those households who have access the authors estimate the determinants of the loan size. It is shown that the availability of collateral, own land and higher education are among the main determinants of the loan size. The chapter points at the importance of e.g. land title granting procedures and of higher education in order to improve access to credit. Vo Thi Lang, Ngo Thi Thanh Truc, Huynh Thi Dan Xua, and Mai Van Nam compare two rice production models that are used in the Mekong Delta. More specifically, they compare the so-called "three reductions three gains" approach with a more historical approach. The three reductions refer to reductions in three inputs: seeds, inorganic fertilizers and pesticides, whereas the three gains refer to gains in the outputs yield, rice quality and profits. The aim of the "three reductions three gains" program was to cut costs and raise rice quality by changing rice-farming practices in the Mekong Delta. The study suggests that in general the program was successful. Yet, also some criticism are made. It, for instance, seems as if the aimed reduction of pesticides and aimed improvement of yields has not been realized. In the last chapter of this book, Huynh Truong Huy, Le Tan Nghiem, and Mai Van Nam examine the impact of diversification in the rural sector in the Mekong Delta. The chapter describes patterns of diversification within farm households in the Mekong Delta, explains the determinants of income of farm households, and identifies diversification constraints in farming. Using data from a field survey and some existing secondary data the study finds that a

household's decision to allocate resources strongly depends on the natural ecological conditions of the area. It also shows that households can gain additional income from rural non-farming activities, and thereby point at the importance of diversification. Finally, the study convincingly points at the relationship between household income and the extent of diversification.

# AN OVERVIEW OF THE DEVELOPMENT OF PRIVATE ENTERPRISE ECONOMY IN THE MEKONG DELTA

**Phan Dinh Khoi**
**Truong Dong Loc**
**Vo Thanh Danh**

# 1. INTRODUCTION

Private enterprise (PE) has played a significant role in the economy, particularly in Vietnam's economic development. In 1998 for example, Vietnam's private sector accounted for 41% of GDP and made up 24% of industrial product output. PE's produced a large variety of consumer goods and services and created many jobs for the labour-force. In the Mekong Delta (MD) especially, the private sector has grown rapidly and plays an increasingly important role in the regional economy. The role of private enterprises is not only a decisive element to stable economic development, but also a decisive factor to resolve social issues such as enhancing the role of entreprenuership in the society in this well-know agricultural based region.

Until the recent amendments to the Enterprise Law, the PE sector in Vietnam was overshadowed by State-Owned Enterprises,. The promulgation of the Enterprise Law in 2000, which combined the previous Company Law and Private Enterprise Law, opened the new phase of development for PE's, particularly for small and medium enterprises. The Law aimed to ease business entry for private enterprises by lifting the business licensing requirements (except for a few special types of business) and simplifying the registration process for new enterprises.

A number of intervening policies support the Enterprise Law. These policies established before and after the Enterprise Law are aimed to support the development of the private sector. However they showed different impacts. Some policies are: Decree No.57/CP in 1998 aimed to support private enterprises in import and export activities, or Decree 90 on November 23rd 2001 committed to support the investment of private enterprises through the establishment of the Credit Guarantee Fund.

This study aims to review the development of the PE economy in the MD. The specific objectives are:
- to review the contribution of the PE sector to the regional economy;
- to review the effects of intervening policies to PE growth; and
- to give recommendations for further research.

Data used in this study was collected from surveys of enterprises during 2001-2004 by the General Statistic Office. In addition, reports from the Department of Planning and Investment were collected and used as supplement data for the study of PE at the provincial level. In addition, a number of studies on private

enterprises were reviewed in line with the proposed objectives in order to find out research problems for further study.

In trying to attain the proposed objectives, this paper commits some shortcomings and limitations. The first is the limited source of references and availability of data. There are many issues related to private enterprises that could be chosen for study but the objectives of the study are focused around two main points for the purpose of the project' objectives. In addition, the study serves for setting further research to measure and analyze specific issues of the private sector in the Mekong Delta.

This paper is organized as follows: Section 1 presents an overview of the development of the PE sector. Section 2 reviews the contribution of PE to the MD's economy and presents growth of the PE economy. Section 3 reviews the development of the PE economy. Section 4 reviews the effects of intervening policies to the PE's performance. Finally, section 5 presents the recommendations for the development of the PE sector.


## 2.    AN OVERVIEW OF THE DEVELOPMENT OF PE

*The enterprise* is defined as an economic organization having its own name, assets and a permanent transaction office, and business registration in accordance with the Enterprises Law. The capital may be owned by one or more private companies, one or more individuals, or the government, though the capital portion of the government has to be less than 50% of registered capital. There are four types of domestic private companies in Vietnam namely sole proprietorships, limited liability companies, joint stock companies, and partnerships. Regardless of their scale, PEs can take the form of any type of enterprise. In the MD, small and medium-sized enterprises are the most common form of business in the PE sector. The main characteristics of small and medium enterprises are that these business types i.) tend to have less transparent management structure ii.) are limited in capital and size of operation and equipment, and iii) are less stable and less well paying for employment.

Figure 1 shows PE by legal forms in the MD. Among registered enterprises in terms of ownership, PE consisted of more than 98 percent of numbers of enterprises in the MD with more than 90 percent as the sole proprietorship and limited liability and the rest as the joint-stock and collective enterprises.

2
7.15
14.97
75.88

■ Proprietorship
▨ Limited liability
□ Joint-stock
▨ Collectives
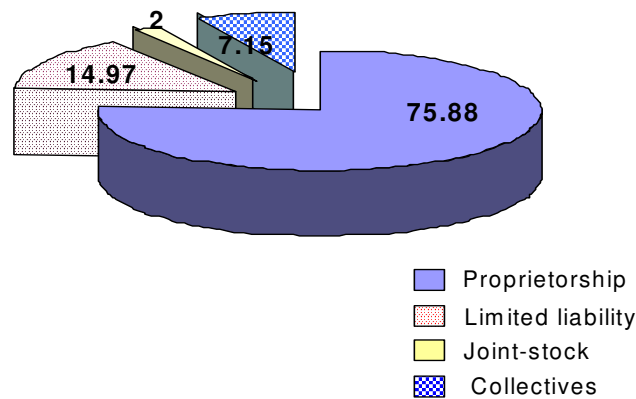
*Source: Department of Planning and Investment of 13 provinces in the MD*

**Figure 1.    Share of PE by legal forms in the MD (December 2004)**

According to statistical data, the distribution of PE in the MD has been unequal in recent years. The majority of enterprises are concentrated mostly in Can Tho city followed by Kien Giang, Ca Mau, and Long An provinces. Distribution of PE can be geographically classified by three groups that show their main activities. The first group includes Ca Mau, Kien Giang, An Giang and Soc Trang provinces which have favorable conditions to develop aquaculture and fishery industries. The number of PE's established in 1999 versus 2003 has doubled after four years in this group. PE in Can Tho city can be classified as a relative one to the others since it is the center city in the MD and receives benefits from development in these coastal provinces through provision of relevant processing industries and other services. The second group of Long An, Dong Thap, Tien Giang and Vinh Long had growed rapidly in number and size since the introduction of the Enterprise Law. Since then this group has continued to grow at a lower rate than the first group. These enterprises have benefited from having a close proximity to Ho Chi Minh City and a good infrastructure including transportation system as compared to the rest in the MD. PE in this group are more engaged in industry, construction and trade such as rice processing, equipment and machinery trading or construction. In the state of development, they somehow developed similarly to the development of private enterprises in Binh Duong and Dong Nai (Dong Nai and Binh Duong are two successful cases of economic development which are close to Ho Chi Minh City). The third group includes four provinces namely Bac Lieu, Tra Vinh, Ben Tre and Hau Giang. The number of PE was small in these provinces and they had lower growth trend. These provinces have disadvantages in natural condition as well as in infrastructure.

# 3. CONTRIBUTION OF PE TO THE ECONOMY

In the MD, the private sector shows its contribution in two main aspects of the economy being industrial output and job creation. First of all, PE contributes to industrial output more so than the state sector in some dominant areas such as rice processing, seafood and fish industries. Second, PE plays an important role in the industrialization and modernization process in Vietnam. The importance of this is expressed in the context of promoting economic growth through gross output and export, as well as stimulating economic development. Moreover, PE plays a role in creating new jobs, effectively mobilizing public funds, and having the ability to meet the fast changing and diversified market economy (Nguyen Danh Vinh, 1999).

Looking at the role of private enterprises in industry; PE plays an important role in encouraging economic structural adjustment as a part of industrialization and modernization. It has helped to adjust and shift the structure of the industrial sector in comparison with the agricultural sector. In 2000, industrial output value of private sector was 9,037.1 billion VND which accounted for 38.73% of total industrial output value of the region. In 2004, this contribution grew to 20,622.4 billion VND which shared almost half of all industrial output value of the MD region. This contribution comes from the whole private sector, however small and medium enterprises make up a significant share in the industrial output value of the region.

**Table 1. Shares of industrial output by economic sectors**
**Unit: %**

| Sector | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| **The MD** | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Domestic sectors | 85.71 | 84.16 | 84.25 | 84.36 | 85.84 |
| State-owned enterprises | 46.98 | 44.88 | 43.64 | 41.20 | 39.54 |
| *PE* | *38.73* | *39.28* | *40.61* | *43.16* | *46.30* |
| FDI | 14.28 | 15.84 | 15.75 | 15.64 | 14.16 |

*Source: GSO ( 2002) and Statistic Data of provinces and city in the MD (2005)*

The rapid growth of the private sector has contributed to the development of the region. Table 2 showed that the average growth rate of the industry was 16.5% from year 2000 to 2004. This growth rate doubled the average growth rate of the 1996-1999 period. Particularly, private sector's growth was 18.1%, three times higher than the general growth rate of 1996-1999's period. This trend implied that the private sector's growth was the result of new start-up

companies in the industry and/or existing companies expanding their business after issuance of the Enterprise Law.

It is showed that in the period of 2000 – 2004, the PE contributed significantly to GDP of the region. Table 2 shows that the private sector had an average growth rate of industrial output of 18.1%. three times higher than the general growth rate of 1996-1999's period. This trend implied that the private sector's growth was the result of new start-up companies in the industry and/or existing companies expanding their business after issuance of the Enterprise Law.

**Table 2.  Growth rate of industrial output of private enterprises in the MD**
**Unit: %**

| Period | The MD | Domestic sectors | State Owned Enterprises | Private enterprises | FDI |
|---|---|---|---|---|---|
| 1996 | 7.5 | 9.1 | 12.9 | 5.3 | -11.3 |
| 1997 | 8.7 | 8.5 | 10.0 | 6.8 | 11.7 |
| 1998 | 7.8 | 6.2 | 8.8 | 3.3 | 30.8 |
| 1999 | 6.7 | 4.9 | 4.2 | 5.8 | 27.5 |
| 2000 | 12.4 | 10.8 | 12.1 | 9.3 | 27.5 |
| 2001 | 17.3 | 16.5 | 17.5 | 15.3 | 24.1 |
| 2002 | 15.9 | 15.3 | 16.1 | 14.2 | 20.6 |
| 2003 | 20.5 | 20.6 | 13.7 | 28.0 | 19.6 |
| 2004 | 16.4 | 18.4 | 11.7 | 24.8 | 5.4 |
| *1996 - 1999* | *7.7* | *7.2* | *8.9* | *5.3* | *13.4* |
| *2000 - 2004* | *16.5* | *14.2* | *14.2* | *18.1* | *19.2* |

*Source:    General Statistic Office (2002) and Statistic Data of provinces and city in the MD (2005)*

PE has also played an important role in job creation. This is probably the most noteworthy achievement of PE in the MD region where the biggest challenge it faces is providing work for its rapidly growing labor force. At the national level, PE is said to have contributed 8.8% to the nation's GDP, 31% to total industrial production value, and created jobs for 26% of the country workforce. In 2001, total employment of the private sector in the MD was more than 100,000 of which a large number of employees working for the private sector fell into the sole proprietorship category that accounted for 50% of all employees in the private sector. Number of employees working in processing industry accounted for more than 55% of total followed by construction industry and trade & services (motor preparation, appliances trade, etc.) which accounted equally about 10%. Looking at limited liability companies, the number of employees was about 26,000, accounting for only 6% of employement. This implied a slow

start of limited liability form as compared to sole proprietorship in the Mekong shortly after the Enterprise Law was implemented.

It is realized that there is a relationship between industrial contribution and job creation in private sector's performance. As mentioned in the previous section, more than half the total labor-force is employed by the PE sector, which in turn contributes considerably to industrial output. And, industrial output of PE shared 46.3% (increasing from 39% in 2000) of total output in 2004 while the contribution of state-owned enterprises accounted for only 40% (decreasing from 46.9% in 2000). In short, growth and development of PE is a factor to economic growth in the region[1].

The analysis showed that the number of enterprises is large but these are small sized operations and they operate at a low level of technology. PE in the MD was more likely to fall into the small enterprise category in terms of employees and capital. In 2000, more than 47% PE had less than 5 employees, 30% PE had employees from 5 to 9, and 19% enterprises had employees from 10 to 49. The number of enterprises with employees from 50 to 499 was less than 4%. However, the picture had changed in 2002 (Figure 2), two years after the Enterprise Law was implemented. Enterprises with less than 5 employees had fallen somewhat to 34% and enterprises with employees from 10 to 49 increased to 26%. This slight change in percentage makes a significant change in number of PE. Especially, the number of enterprises with employees from 50 to 299 had doubled. This was a positive sign for PE growth in the MD. However, this growth rate was rather low when compared to the Central Highlands and the country in general. In 2002, about half of the enterprises in Vietnam had 10 to 299 employees while only 32% enterprises in MD had from 10 to 299 employees.

---

[1] Private enterprises are the fastest growing in terms of number which constitute for 96% of all enterprises in the country and they are a major source of job creation employing almost half (49%) of the non-agriculture labor force of the country.
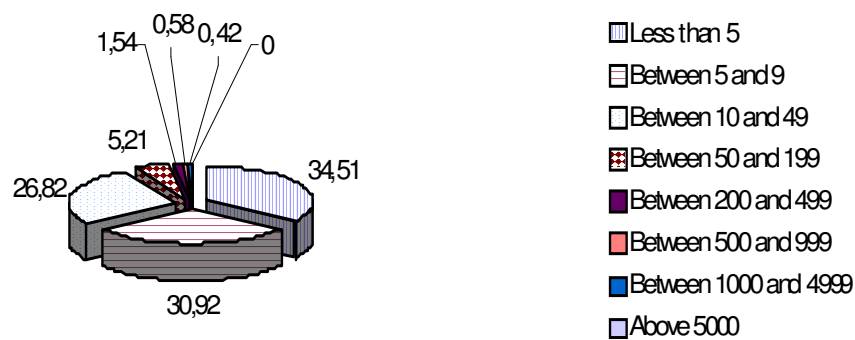
**Figure 2.     PE by number of employees in 2002**
*(Source: General Statistic Office)*

In terms of registered capital, the distribution of enterprises was somehow similar to the number of employees. In 2001, enterprises at micro-level (less than 1 billion VND registered capital) accounted for about 80%, small enterprises accounted for about 16%, and medium enterprises was less than 3%. In 2002, the structure of enterprises by registered capital had changed with more enterprise with capital range from 1 to 10 billion VND. However, registered capital of PE in the MD is still lower than the country's average. This again implied that PE in the MD comprises mainly of micro-enterprises rather than small and medium-sized enterprises. The scale structure of PE has changed over time but this change in structure is still behind the trend set by the rest of the country. Slow-change issues of PE poses problems for policy makers and local authorities that need to be taken into consideration in the future.

In short, the factors that contribute to growth of PE in the region can be summarized as follows:

- Growth of industrial output has significantly contributed to the GDP growth, particularly in processing, seafood and fish industries.

- The number of private enterprises has significantly increased together with the expansion of employment opportunities that also contributes to growth of the economy.

- There was little change in the share of state-owned and private enterprises contribution in the economy over the past five years.

# 4. ENTERPRISE LAW AND THE DEVELOPMENT OF PRIVATE ENTERPRISE

Table 3 presents the number of newly registered PE and their capital investment for two periods 1992-1999 and 2000-2004. The number of newly registered PE's has increased by nearly 50 percent following the introduction of the Enterprise Law. Total registered capital increased from VND 4,670,660 million in the pre-promulgation of the Enterprise Law to VND 13,324,077 million in the post-promulgation of the Enterprise Law.

Regarding the size of newly registered enterprises, it is observed that enterprises established after the issuance of the Law are significantly larger than enterprises established before the issuance of the Law. Specifically, average capital of PE to be registered during the period from 2000 to 2004 is VND 1,653 million while average capital of PE to be registered over the period from 1992 to 1999 is only VND 1,827 million.

**Table 3: Change in number and registered capital of PE in the pre and post period of the Enterprise Law**

| | Before promulgation of Enterprise Law (1992-1999) | After promulgation of Enterprise Law (2000-2004) | Growth | |
|---|---|---|---|---|
| | | | Number | Percentage (%) |
| Cumulative number of newly established PE to be registered (number of PE) | 8,512 | 12,672 | 4,160 | 48.87 |
| Total registered capital (Million VND) | 4,670,660 | 13,324,077 | 8,653,417 | 185.27 |
| Average capital per enterprise (Million VND) | 1,827 | 1,653 | 174 | -0.1 |

*Source: Provincial Departments of Planning and Investment in the Mekong River Delta*

In the period of 2000-2001, the average registered capital of PE in the MD was 1.131 and 1.355 billion respectively, this being higher than the average of the country. The average registered capital started to fall in the year 2002. This meant that new PE registration was mainly in the form of sole proprietorship with a relatively small amount of capital investment. This factor defines the prevalent type of private sector in the MD and it is the biggest constraint in terms of capital for PE to expand their operation. Data in 2002 showed that the number of PE in the MD with capital investment of less than 1 billion accounted for 66.5% of the total as compared to 47.0% in the rest of the country.

Table 4 showed that after five years of implementing the Enterprise Law, the average number of registered enterprises and average registered capital in the MD increased by 18% and 27%, respectively. This is a good outlook for PE in the MD. However, it is still behind the growth rates of the country because average registered capital of private enterprise in the MD equaled to only 81% of the country's average. Therefore again, PE's in the MD tend to fall into the micro-form enterprise category.

**Table 4:     Average registered capital of PE in the MD and Vietnam**

| Year | Average registered capital | | | | Comparison between the MD and Vietnam (%) |
|------|-----------------------------|---------------------|----------------------|---------------------|------|
|      | Vietnam (Billion VND) | Growth rate (%) | The MD (Billion VND) | Growth rate (%) | |
| 2000 | 0.965 | - | 1.131 | - | 117.20 |
| 2001 | 1.295 | 34 | 1.355 | 20 | 104.62 |
| 2002 | 1.785 | 38 | 1.590 | 17 | 89.07 |
| 2003 | 2.089 | 17 | 1.587 | -1 | 75.98 |
| 2004 | 2.042 | -2 | 1.654 | 4 | 80.98 |
| Average (00-04) | 1.653 | 21.75 | 1.463 | 10.00 | 89.40 |

*Source: Data from Departments of Planning and Investment in the MD*

In short, the Enterprises Law has had a positive effect on the development of PE in the Mekong River Delta. Specifically, the cumulative number of new registered PE and their capital significantly increase following the promulgation of these policies.

# 5.   EFFECTS OF INTERVENING POLICIES TO THE PRIVATE ENTERPRISE PERFORMANCE

In this part, five main intervening policies are reviewed in order to show the effects of the policies on the performance of private enterprises.

***Trade policy:*** Trade reform guarantees private enterprises' access to all channels of import and export. Particularly, Decree 57/ND-CP-1998 permits all enterprises to engage in import-export activities within the scope of their registered business without being required to have an import or export license. This decree is a dramatic step forward in Vietnam's trade liberalization for all enterprises including small and medium-sized enterprises.

Prior to Decree 57, under previous import-export regulations, enterprises wishing to import or export were required to obtain foreign trade licenses which in turn required satisfying the following conditions: i) the applicant must be a registered legal entity in accordance with existing laws and operating properly with their registered business activities, ii) working capital level of not less than 200,000 USD by the time of registration except for enterprises located in mountainous and economically difficult areas or enterprises dealing with encouraged exports of less capital investment products, and iii) provide evidence of having staff with appropriate skills and training needed to sign and implement foreign trade. In the MD, many PE could not meet the above conditions therefore they could only export their products by going through a licensed import-export company. Depending on the specific cases, the fees charged by such licensed companies in practice range from 0.5% to 1% per contract. Doing so, small enterprises had to bear significant costs and sometimes lost confidential information concerning the trade contract or even losing trading partners to the licensed companies.

At present, under Decree 57, the only requirements are that the enterprises be registered and that the import and export activities fall within the scope of registered activities. It is regretful that there is no available studies to describe the positive effect of Decree 57 to PE but the decree practically represents significant progress for the trade environment and opens up a "level playing field" for all enterprises. Again, Decree 57 represents a substantial and praiseworthy advance by the Government in providing access to international markets for all enterprises including private enterprises.

***Financial support policy and credit support policy.*** Financial reform that aim to make the credit available for enterprises ensures that banks are able to lend long-term credit to private enterprises with viable investment projects at reasonable rates and terms. Particularly, Decree 90/CP-2001, Article 7 is to form a credit fund for PE whenever they are limited in collateral to acquire a bank loan from a financial institution. After the issuance, it is clear that the policy of equality in access to bank credit has supported PE to improve business performance. Commercial State-owned banks have issued numerous procedures and solutions for PE to attain bank loans. Evaluating credit risk through credit score system, standardizing risk evaluation and keeping in touch with borrowers are among the prioritized key words of every bank. However, a survey on PE in the MD aimed at revealing the actual implementation of this policy found that 80% of small and medium-sized enterprises recieved no financial support and only 11% claimed to have actually received financial support. According to State-owned banks, due to issuance of business registration and management of functional offices, there is no assurance of safe legal practice for financial operation. Besides, some managers lack management skills and financial

statements can be inaccurate and misleading. All those make the banks hesitate to give loans, especially loans without collateral as security.

Despite the Government's aim to encourage PE growth though credit assurance; the conditions and requirements needed to obtain this credit created difficulties for PE's. Especially, the fundamental policy of the Banks relating to land use right certificates has created delays in the access of credit due to the requirement of collateral procedures of bank loans such as certifying business license, land use rights, and so on.

In accordance with Decree 90/CP, the government supports finance for investors through the Investment Development Fund (IDF) by interest incentives. Some provinces executed this Decree widely such as Long An, Can Tho, and An Giang, particularly Long An where about 90% of IDF was released for PE. In some provinces, the IDF support for PE is only existent on paper because of limited budgets. Commercial Banks normally hesitate to contribute to this fund because they perceive it as an unsafe and inefficient investment. Many enterprises' lack the skill neccessary to write a business plan in order to obtain a loan. Once PE's are not able to obtain a formal loan they borrow money from informal sources such as family, friends and others. Sometimes, they have to pay higher interest rates for such loans, some with interest rates of up to 2.5% per month.

***Land policy and land supportive policies at local level.*** Land reform enables enterprises to secure ownership of land or land use rights that are transferable and can be used for collateral. The land reform has had an important impact on industrial development in the private sector. In 1993, the Law on Land has laid out the basis for the allocation of long-term land use rights. The Law affirms "land is the property of the people, and is subject to administration by the State". Thus, formal ownership on land is not changed and individual parties and entities may obtain the legal right to use land but never to own it. The right to use land is instituted and proved by means of a land use right certificate. The certificate of land use right is supposed to reduce uncertainty and to enable land to be used as collateral for loans and credit.

Prior to Decree 18/ND-CP-1995, only few numbers of enterprises, especially small and medium enterprises, have land use right certificates. PE's were not allocated land use rights by the government, accordingly, therefore they must buy or lease land. According to Decree 18/ND-CP-1995, all land use rights in respect of land for commercial and industrial purposes are required to be transformed into land leases. Irrationally, state-owned enterprises are allowed to contribute capital and the value of land use rights to joint ventures with domestic or foreign organizations and individuals while private enterprises are not allowed to do so. It means that PE cannot use their own resource as capital investment.

Recently, local authorities have actively implemented the investment incentive policy for PE in leasing land inside industrial zones as well as exempting taxes and fees for changing land use right to invest in business in accordance with the incentive list of locals. However, the case study showed that 91.24% of small and medium-sized enterprises answered that this policy was not well implemented. These PE's face problems when planning land for industrial purpose in industrial zones that are not pre-defined and face a long waiting time to receive the land use right. Small and medium-sized enterprises perceived that the prices of lease land in these industrial zones are still high and unattractive to investors. Moreover, PE are rather small size and have limited capital therefore they tend not to move into the industrial zones. There was 13.1% who chose not to move because they don't want to pay for transferring costs. More actively, Dong Thap government supported transferring costs for PE to move into industrial zones.

A survey on 91 SME's in Can Tho showed that the number of PE who have land for operation was 24.2% which mainly comprised of food processing, seafood processing and constructions (Do Thi Tuyet, 2005). Normally, these enterprises have more than $2,000m^2$ while there was 13.2% that have land less than $2,000m^2$ of land. The rest 64.6% have less than $500m^2$ of land and mainly engage in trade and services. Among the respondents, there was 51.6% operating on lease land, this number implied that the demand of enterprises on land is quite high as a result of expanding operation, while a survey on 51 PE's in An Giang showed a different picture. Here 80% of PE operated business on their own land. Among that, the average land for food processing was $640m^2$, then construction industry with $510m^2$, and trade and service sectors was $300m^2$.

Many PE's have to manage to find land for setting up new business and operations but investment for land requires capital. Enterprises have to buy land and construct buildings then register their land use rights with the authorities. From that moment, PE's have already paid a large amount for setting up the new business however this is not accounted for in their assets which can not be used to generate capital for reinvestment. As a result, many PE after acquiring land use rights do not have enough capital to buy equipments and built plants.

To summarize, land issues remain one of the biggest challenges for PE, especially small and medium-scaled enterprise. First, land is difficult to acquire for investment purposes. Second, the system of government approval for land use right is still cumbersome. Third, land use rights for commercial and industrial purposes are not clearly specified which will lead to difficulty for PE to acquire land use rights as capital for their operations.

***Tax and tax incentive policies at local levels.*** Nowadays, local tax offices have reformed tax management procedures that improve self-awareness of PE to follow the Tax Law. Enterprises register and pay tax to the state treasury themselves in accordance with the tax forms released by the tax office. Besides, Tax Departments have organized training courses on accounting and taxation for all enterprises. Some 22% of PE participated in taxation training out of 300 enterprises asked (cited from Do Thi Tuyet, 2005).

Some shortcomings arising from the survey showed that amendment and reform on tax policy have been fast changing which affect decision-making of PE. The management and monitoring of tax remains cumbersome and overlapping. This is especially evident in the tax department and Custom office in regards to determining codes for import and export products. Besides, some enterprises complained that if they pay tax late they will be fined but if a tax refund is late then the tax office offers no compensation.

***Training human resource policies.*** Local governments have supportive activities to train human resource for PE such as offering training courses on management skills techniques for managers. Besides, local authorities also give financial support for small and medium enterprises to send employees to get training and encourage them to be more effective.

Currently, there is a Center for Promotion of Small and Medium Enterprises established in every province in the MD in order to carry out training and other activities for small and medium-scale enterprises. However, the resources of these centers are not sufficient to provide updated vocational training as well as consulting services on the scale needed by enterprises. Besides, PE does not perceive the role of these centers even though these centers could act as a bridge connecting PE with the Government. This is the current issue of communicating between government and PE in the MD. Again, most enterprises in the survey raised the problem of accessing relevant business information. This included not only information on markets and customers both domestic and abroad, but also information on government regulations and policies.

Education of business owners is a big constraint to PE growth. According to a survey of 91 enterprises in Can Tho, about 57% of owners in limited liability companies and joint-stock companies have finished college, the rest have finished high school and technical school and usually fall into sole proprietorships roles. Most enterprises' realize that management skill is necessary for business. However, the participation rate of enterprises in these courses is particularly low in the region. This matter was also reported by VCCI Can Tho that there were a number of training courses for PE but few PE's sent their staff to such training courses.

# 6. CONCLUSIONS AND RECOMMENDATION

**Conclusions**

PE is an important sector of the Delta's economy by its notable contribution. Its contribution to industrial output recently was higher than the state sector. For instance, its contribution to industrial output value has increased from 45% in 2000 to 54% in 2004. The private sector's economy was dominating in some favorable areas in the region such as rice processing, seafood and fish industries. Moreover, in these sectors, PE provided a significant number of jobs as well as contributed to the GDP of the Region.

The effect of policies on PE development is recognized in the MD. Since the Enterprise Law was introduced in 1999, the number of newly registered enterprises has considerably increased. After five years of implementing the Enterprise Law, the average number of registered enterprises and average registered capital increased by 18% and 27%, respectively. Total registered capital increased almost twice after the Law was imposed. The average scale of PE also increased more than twice. In short, policies had a positive impact on development of private sector in the region.

Private enterprises in the MD registered as very small-scale in terms of investment capital. Enterprises having capital of less than 1 billion VND accounted for 80% of all PE. This implies that PE in the MD is mainly in the form of very small scale (so called micro-enterprises) rather than small and medium-sized enterprises. The scale structure of PE has changed over time but small and medium scales remain dominant in the MD.

Among the defined policies supporting PE, some have positive impacts on the performance of the private sector while some others have not proven their positive impacts. Supportive policies for PE to exploit their internal resources such as land policy and human resource training show a direct positive result while tax incentive and financial support policy show some short-coming and biased results.

**Recommendations**

There is a need for further research into why enterprises in the MD are of such micro and small sizes relative to other region in the country. It is assumed that many enterprises in the MD have formally registered as private enterprises due to transparent business registration. Another reason is that a smaller size of the enterprises would allow enterprises use temporary, family labor that does not require formal reporting. Even small size gives private enterprises the flexibility to respond to market demand and to make continuous adjustment in product mix and quality that underpin continuous productivity gains. Therefore, research on

what are the key factors that are behind the small-size nature of private enterprises in the MD may have significant policy implication.

There is a need for further research into the impact of the Enterprise Law to the development of PE in the MD. Since the introduction of the Enterprise Law, it has  showed positive changes in the PE sector in terms of number of registered enterprises as well as its contribution. However, there was no specific study on its total impact as well as partial impacts on specific sectors of the economy.

In short, based on the research findings, it is necessary for further research to look closely at the efficiency and productivity of PE in different scales by applying economy of scales and production theory. Moreover, study on the impacts of policies to the performance of PE is also necessary to provide insights for policy-makers to develop further the private sector.

# REFERENCE

Better Task Force (1999). *Regulation and Small Firms*: Progress Report, Cabinet Office, London

Do, Thi Tuyet (2005). Solutions for Promoting and Enhancing Competitiveness of SMEs in the MD. Research Paper, School of Economics and Business Administration, Can Tho University.

GSO (2004). The real situation of enterprises through the results of surveys conducted in 2001, 2001, 2003. Statistic Publishing House.

Hansen, H, Rand, J, and Tarp, F. *SME Growth and Survival in Vietnam*: Did Direct Government Support Matter?

Le, Khuong Ninh (2005). Factors affecting to Investment of PE in the MD. Research Paper, School of Economics and Business Administration, Can Tho University.

McMahon, R.G.P. (1998). Development Orientation and Business Growth and Performance amongst Australian Manufacturing SMEs: Research Paper, School of Commerce, The Flinder University of South Australia

Nguyen H.N (2005). Solutions for Small and Medium Enterprises' Development in Dong Thap. Undergraduate thesis, School of Economics and Business Administration, Can Tho University.

Nguyen, KhacVien (1980). *Vietnam Five Years After*. Hanoi, Foreign Language Publishing House.

Nguyen, Danh Vinh (1999). Overview of non-state small and medium-sized enterprises in Vietnam.

Report of Ministry of Planning and Investment (1999). Improving Macroeconomic policy and reforming administrative procedures to promote development of small and medium enterprises in Vietnam.

Phan, Thi Anh Tho (2005). Solutions for Small and Medium Enterprises' Development in Can Tho. Undergradute thesis, School of Economics and Business Administration, Can Tho University.

VNCI Report (2005). Financial incentives to domestic investment in Vietnam.

# APPENDIX

**Appendix 1. Review some policies regulated PE in period 1986-2000**
In this period, there were three main areas of policy that had been reformed and specifically aimed at capital mobilization and development of enterprises. The major reforms regarding trade, financial and land policies that have been carried out in the past 15 years are as follows:

| Year | Policies |
|---|---|
| 1987 | • The central treasury created to manage the state budget.<br>• Law on Import and Export Taxes promulgated. |
| 1988 | • Degree on foreign exchange control liberties the retention of foreign exchange, the opening of foreign currency accounts, and the use of foreign exchange transfers to pay for imports and repay foreign debts. |
| 1989 | • Almost all form of direct subsidization of production and price control were removed, bringing an end to the « two-price » system.<br>• Domestic trading in gold legally allowed.<br>• Bank interest rates made positive terms. |
| 1990 | • Private Enterprise Law and Company Law, creating the foundation for the formation of formal private sector<br>• Profit tax introduced.<br>• Turnover tax introduced.<br>• Ordinance on Income tax of High Income promulgated. |
| 1991 | • Foreign exchange trading windows opened at the State Bank.<br>• The Agricultural Bank of Vietnam allowed to lend to farming households. |
| 1992 | • New Constitution allowed individuals to exercise ownership rights over income producing assets and personal property. |
| 1993 | • New Law on Land allowed agricultural land use rights to be transferable and useable as collateral.<br>• Law on Agricultural Land Use Tax introduced. |
| 1994 | • Law on Promotion of Domestic Investment increases the roles of different levels of government in licensing and creating incentives for domestic enterprises.<br>• Amendment on 1990 Ordinance on Income Tax. |
| 1995 | • New regulation on land and restricts the nature of land use rights for private sector and limits the right to mortgage land use rights held by domestic organizations.<br>• The General Department for Managing State Capital and Assets in SOEs created in the Ministry of Finance. |
| 1996 | • Credit activities exempted from turnover tax.<br>• Law on State Budget determines the mechanism for budgetary management and the responsibilities for revenue and expenditure of different government levels.<br>• The first Public Investment program adopted. |
| 1997 | • Law on Value Added Tax promulgated<br>• Law on Corporate Income Tax promulgated<br>• 1994 Ordinance on Income Tax of High Income amended. |
| 1998 | • Decree No.57/CP stated that all enterprises, regardless of their ownership, may export without having to apply for export or import licenses. |
| 1999 | • VAT Tax Law, a new tax system was introduced to avoid the overlapped taxation. However, enterprises are still subject to too many VAT rates |

**Appendix 2. Review some policies regulated PE in period 2000 - present**

Recognizing the important roles of private enterprises to economic development of the country in the context of global economic integration within the past 5 years, The Vietnamese government implemented programs and solutions in order to boost this type of business.

| Year | Policies |
|---|---|
| 2000 | • Enterprise Law came into effect that was vitally reorganized the structure as well as operation of private enterprises. |
| 2001 | • Decree No. 90/2001 for promotion and development of small and medium enterprises. |
| 2002 | • Decision No. 562/QD of Ministry of Planning and Investment on responsibility and management of Small and Medium Enterprises (SMEs) Development Bureau. |
| 2003 | • Decision No. 185/QD on regulations for SMEs Development Bureau. <br> • Direction of Prime Minister on enhancing efficiency and competitiveness of SMEs. <br> • Instruction 109/CP on business registration in the context of Enterprise Law which prevented errors and abuses in business registration process |
| 2004 | • Resolution No. 181/CP on Land Law amended on land use rights of enterprises |
| 2005 | • The Unified Enterprise Law and Common Investment Law are being discussed, drafted and are expected to be passed in 2006. |

**Appendix 3: Structure of enterprises by legal forms by Dec 2004**

| Province | Private sector | | | | |
|---|---|---|---|---|---|
| | Total | Sole proprietorships | Limited liability company | Joint-stock company | Collectives |
| **The MD** | **100.00** | **75.88** | **14.97** | **2.00** | **7.15** |
| Long An | 100.00 | 70.72 | 24.11 | 2.68 | 2.49 |
| Dong Thap | 100.00 | 71.84 | 15.58 | 1.61 | 10.97 |
| An Giang | 100.00 | 75.20 | 15.59 | 0.87 | 8.34 |
| Tien Giang | 100.00 | 88.77 | 5.54 | 0.87 | 4.82 |
| Vinh Long | 100.00 | 78.13 | 16.53 | 1.41 | 3.93 |
| Ben Tre | 100.00 | 48.43 | 32.68 | 4.32 | 14.57 |
| Kien Giang | 100.00 | 82.10 | 11.36 | 1.35 | 5.19 |
| Can Tho | 100.00 | 65.33 | 25.05 | 3.98 | 5.64 |
| Hau Giang | 100.00 | 74.68 | 8.20 | 2.73 | 14.39 |
| Tra Vinh | 100.00 | 67.35 | 10.25 | 1.89 | 20.51 |
| Soc Trang | 100.00 | 75.05 | 12.52 | 2.88 | 9.55 |
| Bac Lieu | 100.00 | 79.98 | 5.58 | 0.95 | 13.49 |
| Ca Mau | 100.00 | 85.41 | 7.79 | 1.56 | 5.24 |

*Source: Department of Planning and Investment of 13 provinces in the MD*

**Appendix 4: Output value of industry (1994 price)**

Unit: Billion VND

| | 2000 | 2001 | 2002 | 2003* | 2004* |
|---|---|---|---|---|---|
| **The MD** | **23,333.10** | **27,696.73** | **31775.02** | **38275.10** | **44542.01** |
| Domestic sectors | 19,998.80 | 23,308.65 | 26769.82 | 32289.60 | 38235.78 |
| State-owned enterprises | 10,961.70 | 12,429.67 | 13866.00 | 15769.40 | 17613.38 |
| *Private sector* | *9,037.10* | *10,878.98* | *12,903.82* | *16,520.20* | *20,622.40* |
| FDI | 3332.40 | 4,388.08 | 5,005.20 | 5985.50 | 6306.23 |

*Source: General Statistic Office, 2002;* Statistic Data of provinces and city in the MD*

**Appendix 7: Share of industrial output of private sector in the MD**    Unit: %

| | 2000 | 2001 | 2002 | 2003* | 2004* |
|---|---|---|---|---|---|
| Domestic sectors | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| SOEs | 54.81 | 53.33 | 51.80 | 48.84 | 46.07 |
| *Private sector* | **45.19** | **46.67** | **48.20** | **51.16** | **53.93** |

*Source: General Statistic Office, 2002;* Statistic Data of provinces and city in the MD*

**Appendix 4. Number of private enterprise by capital**

| | Total | Scale of PE by capital | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Below 0,5 Billion | 0,5 B to 1 B | 1 B to 5 B | 5 B to 10 B | 10 B to 50 B | 50 B to 200 B | 200 B to 500 B | Above 500 |
| **Vietnam** | **72,012** | **18,790** | **12,954** | **24,737** | **5,496** | **6,648** | **2,491** | **586** | **310** |
| **The MD** | **11,032** | **4,300** | **2,391** | **3,224** | **478** | **427** | **160** | **46** | **6** |
| Long An | 947 | 317 | 174 | 296 | 58 | 67 | 26 | 6 | 3 |
| Tien Giang | 1,391 | 755 | 248 | 284 | 35 | 53 | 12 | 4 | |
| Ben Tre | 909 | 566 | 153 | 138 | 18 | 20 | 12 | 2 | |
| Tra Vinh | 385 | 158 | 63 | 106 | 31 | 20 | 6 | 1 | |
| Vinh Long | 755 | 315 | 149 | 216 | 39 | 29 | 6 | 1 | |
| Dong Thap | 795 | 290 | 160 | 264 | 46 | 22 | 9 | 4 | |
| An Giang | 1,004 | 283 | 203 | 375 | 62 | 55 | 19 | 7 | |
| Kien Giang | 1,458 | 453 | 382 | 536 | 52 | 19 | 12 | 2 | 2 |
| Can Tho | 1,277 | 452 | 277 | 352 | 70 | 83 | 32 | 11 | 0 |
| Soc Trang | 656 | 225 | 171 | 200 | 29 | 21 | 6 | 3 | 1 |
| Bạc Lieu | 560 | 203 | 176 | 146 | 11 | 19 | 4 | 1 | |
| Ca Mau | 895 | 283 | 235 | 311 | 27 | 19 | 16 | 4 | |

*Source: Department of Planning and Investment of 13 provinces in the MD*

**Appendix 5. Number of enterprises before and after the Enterprise Law**

| | At the end of 1999 | | | At the end of 2004 | | |
|---|---|---|---|---|---|---|
| | No. Ent. | Registered capital (M. VND) | Ave. registered capital (M. VND) | No. Ent. | Registered capital (M. VND) | Ave. registered capital (M. VND) |
| An Giang | 1,116 | 320,853 | 287,503 | 1,200 | 1,902,542 | 1,585 |
| Bac Lieu | 740 | 208,423 | 282,000 | 608 | 550,278 | 905 |
| Ben Tre | 489 | 65,917 | 135,000 | 430 | 681,233 | 1,584 |
| Can Tho | 996 | 416,039 | 418,000 | 2,065 | 3,159,236 | 1,530 |
| Ca Mau | 450 | 482,186 | 1,072,000 | 1,366 | 1,520,932 | 1,113 |
| Đong Thap | 471 | 299,278 | 635,000 | 760 | 820,849 | 1,080 |
| Hau Giang[2] | 0 | 0 | 0 | 482 | 456,311 | 947 |
| Kien Giang | 1,306 | 1,053,527 | 807,000 | 1,421 | 4,614,433 | 3,248 |
| Long An | 1,088 | 1,230,600 | 1,131,000 | 1,822 | 2,187,159 | 1,200 |
| Soc Trang | 568 | 74.711 | 132,000 | 785 | 997,700 | 1,271 |
| Tien Giang | 1,027 | 504.246 | 491,000 | 1,083 | 1,131,604 | 1,045 |
| Tra Vinh | 458 | 428.139 | 935,000 | 493 | 605,176 | 1,228 |
| Vinh Long | 639 | 571.752 | 895,000 | 707 | 1,322,664 | 1,871 |
| *The MD* | *8,233* | *5,655,670* | *687* | *13,222* | *19,950,116* | *1,509* |

Source*: Data fromDepartments of Planning and Investment in the MD (2005)*

**Appendix 6. Number of yearly registered enterprises after the Enterprise Law**

| | No. of Enterprises | Registered capital (M. VND) | Ave. registered capital | No. of Enterprises (%) | Registered capital (%) |
|---|---|---|---|---|---|
| 2000 | 1.969 | 2.227.147 | 1.131,11 | 100.00 | 100.00 |
| 2001 | 1.956 | 2.650.106 | 1.354,86 | 99.00 | 119.00 |
| 2002 | 2.207 | 3.508.931 | 1.589,91 | 113.00 | 132.00 |
| 2003 | 2.577 | 4.090.391 | 1.587,27 | 117.00 | 117.00 |
| 2004 | 4.511 | 7.459.838 | 1.653,7 | 175.00 | 182.00 |
| | Average growth rate  2000 – 2004 (%) | | | **118.00** | **127.00** |

*Source: Data from Planning and Investment Department of the MD*

---

[2] Hau Giang was separated from Can Tho City in 2003.

**Appendix 7. Number of employees in private sector by activites**

| | The MD | | | | |
|---|---|---|---|---|---|
| | **Total** | **Sole Proprietorship** | **Limited liability company** | **Collectives** | **Others** |
| Mining industry | 652 | 85 | 106 | 438 | 23 |
| Processing industry | 64,539 | 28,590 | 24,052 | 4,337 | 7,560 |
| Construction | 13,389 | 5,671 | 4,761 | 2,380 | 577 |
| Trade and prepare motors and motorcycles | 18,099 | 16,066 | 1,329 | 350 | 354 |
| Hotels and Restaurants | 1,688 | 1,244 | 377 | 22 | 45 |
| Transport, warehouse and communication | 12,359 | 879 | 268 | 11,059 | 153 |
| Finance | 1,734 | 101 | 0 | 1,143 | 490 |
| Consulting and real estate | 228 | 99 | 70 | 16 | 43 |
| Education and training | 6 | 6 | 0 | 0 | 0 |
| Health care | 186 | 52 | 94 | 0 | 40 |
| Cultural and sport activities | 4 | 4 | 0 | 0 | 0 |
| Personal services | 159 | 129 | 0 | 30 | 0 |
| **Total** | **113,239** | **52,982** | **31,071** | **19,901** | **9,285** |

*Source: Department of Planning and Investment of 13 provinces in the MD*

**Appendix 8. Number of employees in SMEs by December 2000**

| | **The MD** | **%** | **Vietnam** | **%** |
|---|---|---|---|---|
| ***Employees by private sector*** | ***104,125*** | ***100*** | ***893,124*** | ***100*** |
| *Sole propreitorship* | *49,979* | *48.0* | *177,141* | *19.8* |
| *Limited liability company* | *25,966* | *24.9* | *430,656* | *48.2* |
| Collectives | 19,232 | 18.5 | 176,979 | 19.8 |
| Other | 8,948 | 8.6 | 108,348 | 12.2 |

*Source: The result of the enterprise census at 1$^{st}$ April 2001, GSO*

# AN OVERVIEW OF THE DEVELOPMENT OF THE AGRICULTURAL ECONOMY IN THE MEKONG DELTA

**Nguyen Huu Dang**
**Vo Thanh Danh**

# 1.  INTRODUCTION

The Mekong Delta (MD) is a region located in the lower part of the Mekong river with a total area of approximately 40,000 km$^2$. It is the main agricultural production region in Vietnam due to fertile soils and abundant water sources.

The MD comprises about 4 million ha of rice area, from which more than 18 million tons of rice is produced annually – half of the total amount of paddy rice in the country. The Delta is also the biggest sugar cane producer in the country, accounting for one-third of national sugar production. It is also a large fruit producer with more than 252,000 thousand ha and 3 million tons of fruit produced annually. The establishment of large fruit production areas in Can Tho, Vinh Long, Ben Tre, Dong Thap, and Tien Giang provinces in recent years has created an absolute advantage for the Delta. Consequently, it has become the largest specialist fruit region in the country.  Livestock and Aquaculture are also important with the Delta's share of national pig and aquaculture production at 24 and 60 percent respectively.

According to the UNDP development report (1999), the MD's development index is at an average rank. The human development index rates third amoung seven economic zones – lower than the average national position. However, the biggest disadvantage to the development of the MD is poor human resources.

Economically, GDP per capita is relatively high (ranked third and contributing to twenty-one percent of national GDP). The agricultural sectors contribution to regional GDP is also very large (contributing to 55 percent of regional GDP as compared with the national agricultural sector which contributes to only 30 percent of national GDP). The growth rate of this sector is about 3.1 percent per year.

In recent years there has been a shift in Vietnam's economic structure with a movement towards industry and service sectors and away from the agricultural sector. Despite a decline in the agricultural sector's contribution to total GDP, the MD still comprises the largest agricultural production area in the country and has comparative advantages in many agricultural products. The annual growth rate of agricultural sector in the period of 2000-2004 was 7 percent, a figure significantly higher than the other regions.

This impressive growth rate is largely explained by an increasing aquaculture sector that has had a growth rate of 17 percent per year (as compared with crop and livestock sectors that have increased at a more modest growth rate of 3.1 percent per year). This growth rate is almost double that of the 1995-2000 period.

The growth is due to a change in the structure of agricultural production away from traditional sectors and towards the aquaculture sector. Consequently, land

use for rice and crop production has reduced by 200,000 ha (from 2,082,662 ha to 1,894,084 ha) whilst land used for aquaculture production has increased (from 445,000 ha to 644,800 ha). Clearly, in recent years (since economic reform in 1986) there has been a shift toward high value-added production sectors like the aquaculture sector while sectors such as rice production have played a less important role.

This paper aims to review the development of the agriculture sector in the MD. The specific objectives are:

1. to review the growth and the structural change of the agricultural sector;
2. to measure the contribution of the agricultural sector to the MD economy;
3. to measure the specialization in production for key agricultural products; and
4. to set up recommendations for further research into possible options for higher levels of agricultural development.

Data used in the paper was collected from the General Statistics Office (GSO) for the 1995-2005 period. Additionally, the socio-economic statistics of 13 provinces in the MD were also used. The specialization index is used to show the specialization in the production of key crops in the MD.

$$SP_{ij} = R_{ij}/R_i \qquad\qquad (1)$$

$$R_{ij} = A_{ij}/\sum A_{ij} \qquad\qquad (2)$$

$$R_i = A_i/\sum A_i \qquad\qquad (3)$$

Where $SP_{ij}$: Specialization index of commodity i in province j;
$\quad$ $R_{ij}$: Proportion of commodity i in harvested areas of province j;
$\quad$ $R_i$: Proportion of commodity i in harvested areas of the MD;
$\quad$ $A_{ij}$: Harvested areas of commodity i in province j; and
$\quad$ $A_i$: Harvested areas of commodity i in the MD.

In the model (1), if $SP_{ij}$ is greater than one then province j is specialized in commodity i.

The paper is organized in four sections. Section 1 presents an overview of the growth and structural change in the agricultural sector. Section 2 shows the contribution of the agricultural sector to the regional economy. Section 3 presents an analysis of the specialization in producing key agricultural products in the MD. Lastly, section 4 presents recommendations and policy implications and outlines potential research in the field of agricultural economics.

# 2. AN OVERVIEW OF GROWTH AND STRUCTURAL CHANGE IN AGRICULTURE

## 2.1. Growth of the agricultural sector

The MD had high economic growth in the 1996-2004 period with an annual growth rate of 11.2 percent (compared with the national growth rate of 7.0 percent). During the Asian financial crisis and economic recession of 1997-1999, the MD managed to maintain an economic growth rate of 8.0-10.0 percent per annum while the national growth rate fell to its lowest recorded rate of 4.8 to 5.8 percent. This shows that the regional economy was less affected by the Asian financial crisis than the rest of the country.

In the same period, the agricultural, industry and service sectors grew at at average rate of 4.6, 14.7 and 11.6 percent respectively. Figure 1 shows the growth of the three economic sectors from 1996 to 2004. Up to 1999, the industry and service sectors faced low growth while the agricultural sector had an impressive growth rate of eight percent per year. However, since 2000 both the industry and service sectors have recovered and maintained a higher growth rate. In 2004, growth in the agricultural sector was only 5.5 percent.

## Rice production

In the MD, rice is still the most important crop. In 2004, the total rice area of the MD was 3.8 million ha, accounting for 86 percent of total crop area. The average rice yield was 4.9 tons/ha and total paddy rice production was 18.5 million tons. In the period of 2000-2004, rice area decreased by 0.8 percent annually whereas the yield and output increased by 3.3 and 2.4 percent per annum respectively. Figure 2 shows area, yield and production of rice in this period.
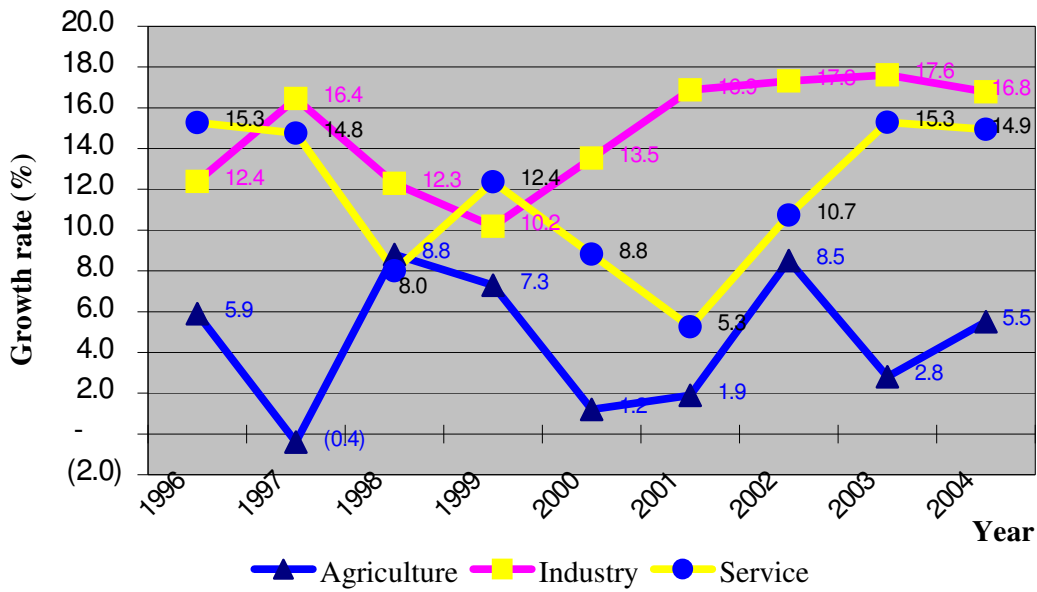
Source: Socio-economic statistical delta of Mekong Delta, 2005.

Figure 1: Growth of economic sectors in the MD, 1996-2005



**Figure 2: Growth of area, yield and production of rice, 1996-2004**

There are three annual rice crops in the MD – Winter-Spring, Summer-Autumn, and Autumn-Winter. The Winter-Spring crop is the main provider of rice exports. Over the per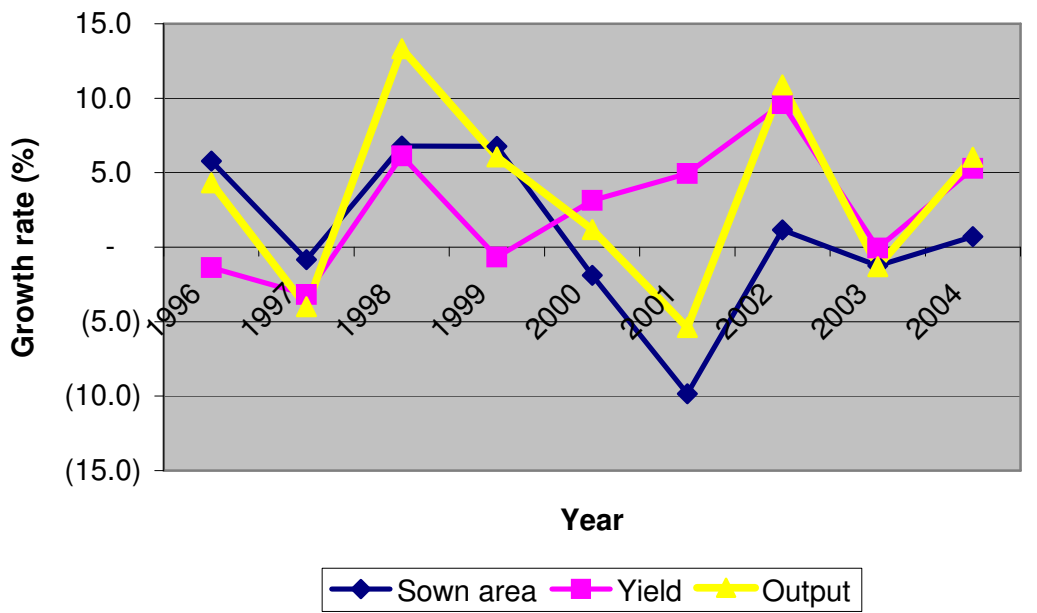iod of interest, the cultivationn area in this crop has decreased by an average of 0.8 percent annually whereas the yield has increased by 2.3 percent annually. By comparison, the cultivation area in the Summer-Autumn and Autumn-Winter crops have, on average, decreased by 1.8 percent and increased by 1.8 percent annually whereas the yield areas have increased by an average of 4.0 and 3.1 percent annually, respectively. As a whole, rice production in the MD has increased by 22.1 percent over the 2000-2004 period. This increase is due to the increase in rice yields despite the overall decrease in cultivation area.

From these results we can draw an interesting conclusion. Changes to intensive farming systems in recent years rather than the traditional approach of increased cultivation areas (as used in the 1990s) has helped increase rice production. Table 1 shows the growth of rice production in the period of 2000-2004.

The MD is currently facing new challenges with the old rice farming systems. Natural resources in the area are being exploited with three annual crops and this is creating serious consequences for the sustainability of the rice production system. The first problem is the efficiency by which water resources are provided for competing crops. That is, it is impossible to fully provide water for multicropping for the entire region. Despite the fact that rice systems have been integrated with the cropping calendar, rice requires a great amount of water in order to develop. Additionally, multicropping in upstream areas is causing a lack of water in downstream which increases saline intrusion and acid sulfate levels during the dry season. The second problem is soil erosion, along with modern input uses, a three crop per year rotation system seriously degrads the soil.

Increased investment in inputs such as modern fertilizers and pesticides in order to keep decreasing yields constant has been observed in many places throughout the region. These fertilizers and pesticides create environmental impacts in terms of pollution of water sources, which inturn creates increased health risks for the community.


**Aquaculture**

The current decrease in rice area is due to Project 09/2000/NQ-CP, which requires the transfer of land from low yield rice areas to aquaculture production. In 2005, of the 310,841 ha of land transferred to aquaculture production 297,187 ha was rice area. In total, rice area accounted for 84 percent of total land transferred to aquaculture production.

**Table 1:    Rice production in the MD, 2000-2004**

| Item | 2000 | 2001 | 2002 | 2003 | 2004 | Annual average growth rate |
|---|---|---|---|---|---|---|
| Total | | | | | | |
| Area (thousand ha) | 3,947.4 | 3,789.9 | 3,834.3 | 3,786.3 | 3,812.8 | -0.8 |
| Yield (ton/ha) | 4.3 | 4.2 | 4.6 | 4.6 | 4.9 | 3.3 |
| Output (thousand ton) | 16,913.6 | 16,001.1 | 17,744.5 | 17,513.4 | 18,569,3 | 2.4 |
| In which | | | | | | |
| Winter-Spring crop: | | | | | | |
| Area (thousand ha) | 1,520.6 | 1,537.6 | 1,513.7 | 1,499.0 | 1,465.1 | -0.8 |
| Yield (ton/ha) | 5.29 | 5.04 | 5.70 | 5.66 | 5.87 | 2.3 |
| Output (thousand ton) | 8,039.7 | 7,756.5 | 8,631.7 | 8,486.9 | 8,606.9 | 1.7 |
| Summer-Autumn crop: | | | | | | |
| Area (thousand ha) | 1,676.6 | 1,567.2 | 1,587.1 | 1,563.1 | 1,555.7 | -1.8 |
| Yield (ton/ha) | 3.82 | 3.76 | 4.10 | 4.06 | 4.47 | 4.0 |
| Output (thousand ton) | 6,411.0 | 5,886.0 | 6509.7 | 6346.5 | 6953.4 | 2.1 |
| Autumn-Winter crop: | | | | | | |
| Area (thousand ha) | 204.9 | 244.3 | 313.2 | 347.2 | 402.3 | 1.8 |
| Yield (ton/ha) | 3.56 | 3.49 | 3.67 | 3.80 | 4.03 | 3.1 |
| Output (thousand ton) | 728.8 | 852.4 | 1,149.8 | 1,318.2 | 1,619.3 | 22.1 |

*Source: Socio-economic Statistics of Mekong Delta, 2005.*

Table 2 shows the transfer of rice cultivation area to aquaculture production from 1999 to 2005. The most rapid change has occurred since 2000. Specifically in 2000, the rice area transferred to aquaculture area was at a record high of 132,852 ha – more than forty percent of total transferred area during the 1999-2005 periods.

**Table 2:** **The change in rice cultivation area to aquaculture production, 1999-2005**
**Unit: ha**

| Region | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 1999-2005 |
|--------|------|------|------|------|------|------|------|-----------|
| Vietnam | 9,806 | 36,214 | 141,530 | 61,911 | 71,429 | 28,293 | 28,086 | 377,269 |
| Mekong Delta | 4,237 | 28,868 | 132,852 | 49,384 | 62,170 | 16,718 | 16,612 | 310,841 |

*Source: Ministry of Fishery, March 2006.*

In 2005, Vietnam has 959,945 ha of aquaculture area, of which 685,250 was located in the MD. In this region, 1,004,257 tonnes of aquaculture is produced with an export value of 1.5 billion $USD. However, the rapid growth of aquaculture production activities has caused many environmental problems including degradation and pollution. Aquaculture production is considered the main contributor to the destruction of ecology systems that were previously very rich and has also destroyed coastal forests. New farming models, or so-called "rice-shrimp systems" have led to increased salinity in the rice fields. Consequently, a new environmentally friendly farming system is required for the Delta.

**Livestock**
The livestock sector contributes 10 percent of the agriculture sector and in the 2000-2004 periods had an annual growth rate of 6.27 percent. However in 2004, the livestock sector was negatively affected by bird flu.
The livestock sector consists primarily of pig production – over 50 percent of total livestock production. In 2004, pig herds reached to 3,713,000 heads occuping 14.1 percent of total area. In 2000-2004, the annual growth rate in pig herds reached 5.67 percent.
Cattle production is the second largest contributor to the livestock sector. Currently, cattle herds occupy approximately 8.5 percent of total area. Cattle production is increasing rapidly, in the 2000-2004 period the annual growth rate of cattle was 20.76 percent. Figure 3 shows growth in the MD livestock sector in 1999-2003.

**Figure 3:** **The trend of growth of livestock production, 1996-2004**
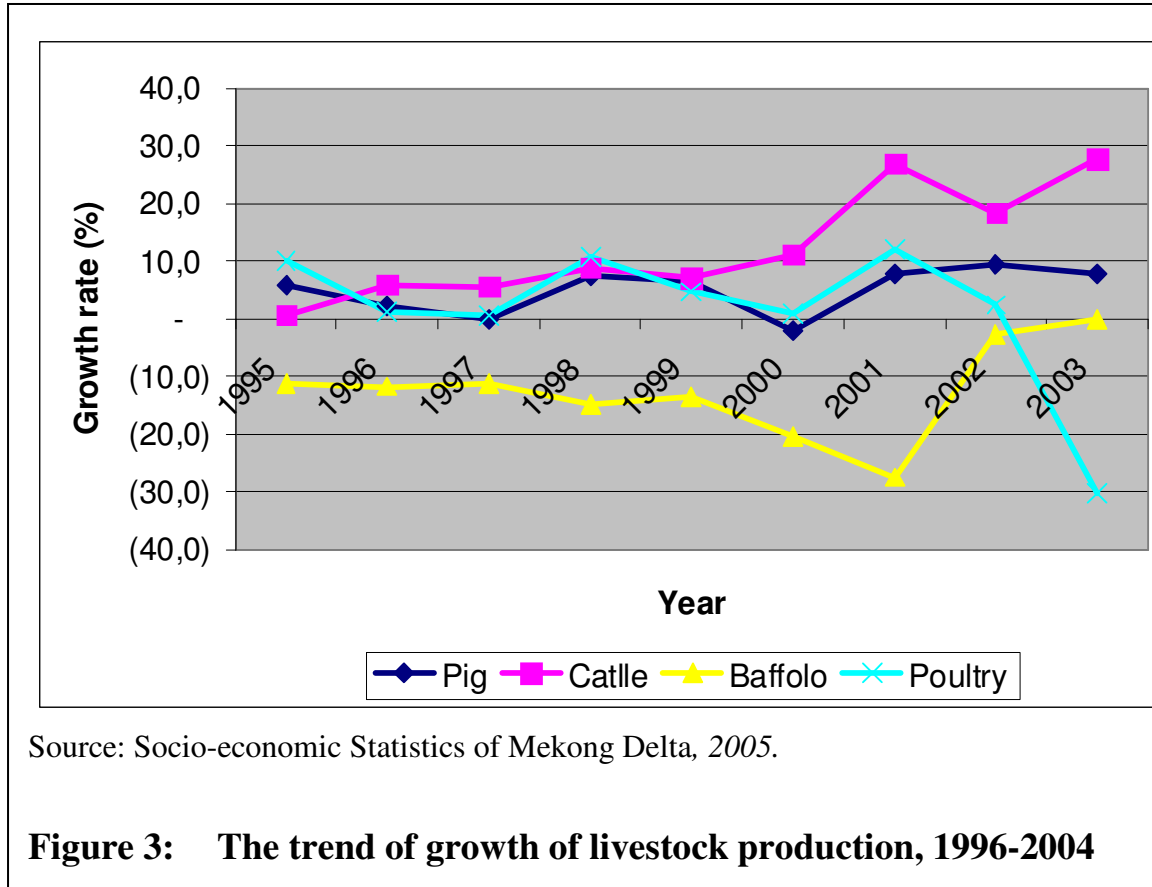
## 2.2.    Changes in economic structure

In 1996-2000, the MD faced rapid economic structural change. There was a movement away from the agricultural sector towards industry and service sectors. In 2000, the agricultural sector's contribution to GDP fell by approximately 10 percent as compared with 1996 to 48.6 percent. Correspondingly, the industry and service sectors increased their contribution to GDP by approximately six and four percent, respectively.

Though there has been consistent improvement in recent years, the economic structure of the Delta has not changed significantly. In 2004, the agriculture, industry, and service sectors contributed 41.6, 34.9 and 23.5 percent of GDP respectively – contributions for the country as a whole were 21.8 percent, 40.0 percent and 38.2 percent, respectively. Table 3 shows the economic structure of the MD and the country in 1996-2004 periods.

**Table 3:  Economic structure in the MD and the country, 1996-2004**
**Unit: %**

| Sector | 1996 | | 2000 | | 2004 | |
|---|---|---|---|---|---|---|
| | Mekong Delta | Country | Mekong Delta | Country | Mekong Delta | Country |
| Agriculture | 58,89 | 27.76 | 48.61 | 24.53 | 41.64 | 21.83 |
| Industry | 21.60 | 29.73 | 27.97 | 36.73 | 34.89 | 39.95 |
| Service | 19.51 | 42.51 | 23.42 | 38.74 | 23.47 | 38.22 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

*Source:  Socio-economic Statistics of Mekong Delta, 2005*

The agricultural sector is classified into three sub-sectors – crops; livestock and fisheries; and agricultural services. In 1995, these sub-sectors made up 84.4, 9.8 and 5.4 percent of the agricultural sector, respectively. Post 1995 there was an increase in the contributions of the livestock and fisheries and agricultural services and a decrease in the contribution of crops. By 2004 crops, livestock and fisheries and agricultural services made up 82.7, 10.5 and 6.8 percent of the agricultural sector, respectively. Figure 3 shows the internal structure of the agriculture sector in 1995 and 2004. Through ten years of development, the agricultural sector has faced little change with crops still the major sub-sector and agricultural services making a small contribution to development

The share of livestock, fishery production and agricultural services in the MD's agricultural sector is 200, 150 and 180 percent larger than the contributions of these subsectors to the agricultural sector at the national level. This shows that in the MD there is a tendancy to modernise the agricultural sector with agricultural services playing a more important role. Table 4 shows the structural change in agricultural production for the 1990-2002 periods.

At the national level, there has been a decline in the contribution of crops to the agricultural sector. Meanwhile, the share of crop production in the MD has increased since 1990, which will need to be changed in order to create a new wave of development in the agricultural sector in the MD.
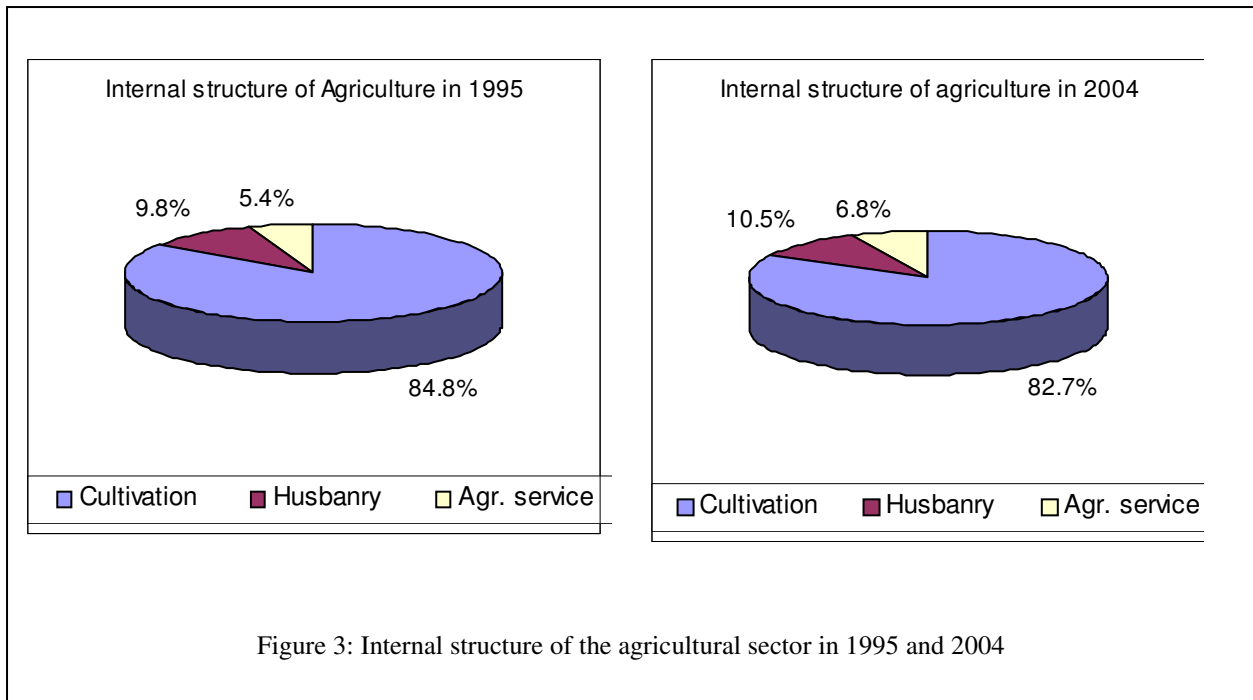
Figure 3: Internal structure of the agricultural sector in 1995 and 2004

**Table 4: Structure of the agricultural economy in the MD, 1990-2002**
**Unit: %**

| Sector | 1990 | | 1995 | | 2000 | | 2001 | | 2002 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coun-try | Me-kong Delta | Coun-try | Me-kong Delta | Coun-try | Me-kong Delta | Coun-try | Me-kong Delta | Coun-try | Me-kong Delta |
| Crops | 79.3 | 58.1 | 78.1 | 69.2 | 78.2 | 66.0 | 77.9 | 61.2 | 76.5 | 61.8 |
| Livestock and fishery | 17.9 | 39.1 | 18.9 | 26.4 | 19.3 | 28.8 | 19.6 | 33.8 | 21.2 | 33.5 |
| Agricultural services | 2.8 | 2.8 | 3.0 | 4.4 | 2.5 | 5.3 | 2.5 | 5.0 | 2.3 | 4.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Source: Hong T.N. (2003)*

# 3. THE CONTRIBUTIONS OF AGRICULTURAL SECTOR

The MD's economy is an agricultural economy. Agricultural production is the main economic activity of the region with 76 percent of population working in the agriculture sector. The share of agricultural value to regional GDP is approximately 45 percent with the MD contributing more than 80 and 50 percent of national rice and aquaculture exports. The contribution of the agricultural sector to regional GDP has declined at a rate of 3.2 percent per

annum – from 76.6 percent in 1995 to 47.8 percent in 2004. Table 5 shows the contribution of the agricultural sector to regional GDP from 1995 to 2004.

**Table 5:     Share of agricultural value to regional GDP**

| Year | Agricultural value (billion VND) | GDP (billion VND) | Share of GDP (%) | Change (+/-) |
|------|----------------------------------|-------------------|------------------|--------------|
| 1995 | 31,335.8 | 40,906.8 | 76.60 | - |
| 1996 | 37,084.2 | 48,876.6 | 75.87 | -0.73 |
| 1997 | 38,678.7 | 54,425.4 | 71.07 | -4.81 |
| 1998 | 48,747.1 | 64,228.2 | 75.90 | 4.83 |
| 1999 | 50,392.6 | 68,553.6 | 73.51 | -2.39 |
| 2000 | 47,081.1 | 71,664.1 | 65.70 | -7.81 |
| 2001 | 44,156.3 | 77,381.3 | 57.06 | -8.63 |
| 2002 | 45,776.5 | 90,345.5 | 50.67 | -6.40 |
| 2003 | 55,433.0 | 102,581.4 | 54.04 | 3.37 |
| 2004 | 57,867.8 | 121,063.0 | 47.80 | -6.24 |

*Source: Socio-economic Statistics of Mekong Delta*

The MD's economy is more dependent on agriculture as compared with the national economy. In 1996, the shares of agriculture, industry, and services were 59.9, 21.6 and 19.5 percent, respectively. This is compared with the national level where the shares are 27.8, 29.7 and 42.5 percent, respectively. That is, the MD's agriculture sector contributes to 60 percent of regional GDP while the total agriculture sector contributes to less than one-third of the national GDP.

In addition, the contribution of the MD's agricultural sector to the total value of national agricultural production declined from 38.5 percent in 1996 to 35.8 percent in 2004. Within the agricultural sector, the two main sub-sectors corps and livestock declined between 1 and 3 percent. This decline in the national agricultural sector raises questions about the importance of agricultural production in the future.

*Source: General Statistics Office, 2004*

**Figure 3:    The contribution of the MD's agriculture to national agricultural production**
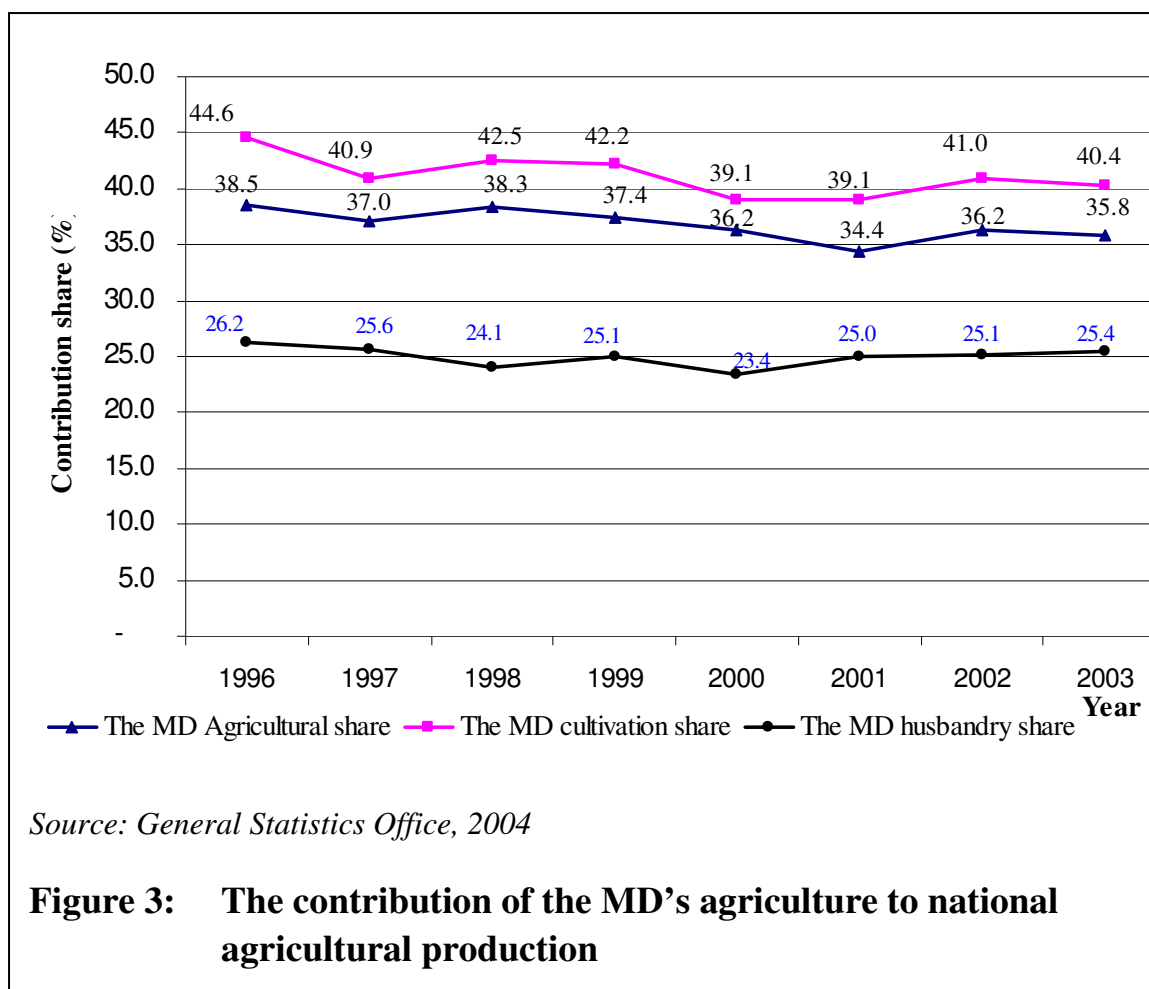
# 4.    SPECIALIZATION IN AGRICULTURAL PRODUCTION

The MD region is considered as a specialization area of agricultural production within Vietnam. Other than rice and aquaculture, other important agricultural products are also produced for domestic consumption and exportation on a large scale. These include Maize, cereals, fruit, vegetable, and perennial crops.

These key agricultural products are known as the speciality products of the MD. To measure the degree of specialization in producing these products at the provincial level, the SP index is employed. Results from the SP index show that some provinces produce all products while other provinces are the producers of only a few products (refer to Table 6 and appendices 1-5). Provinces specializing in all products include Ben Tre and Tra Vinh. Provinces specializing in some products include Tien Giang, An Giang, Dong Thap, Soc Trang, Can Tho, Long An, Bac Lieu, Ca Mau, Hau Giang, and Vinh Long. Kien Giang is the only province in the Delta that does not specialize in any of these products.

**Table 6: Specialization of main agricultural products in the MD**

| Product | Specialization area |
|---|---|
| Maize | Ben Tre, Tra Vinh, Tien Giang, An Giang, Dong Thap |
| Vegetable | Ben Tre, Tra Vinh, Tien Giang, An Giang, Soc Trang, Can Tho, Bac Lieu |
| Cereals | Ben Tre, Tra Vinh, Vinh Long, An Giang, Soc Trang, Ca Mau |
| Fruit | Ben Tre, Tra Vinh, Tien Giang, Can Tho, Hau Giang |
| Perennial crops | Ben Tre, Tra Vinh, Soc Trang, Ca Mau, Hau Giang, Long An |

# 5. CONCLUSION AND RECOMMENDATION

This paper has drawn the following conclusions:

- The MD has an advantage in agricultural production as compared with other regions in Vietnam.

- The growth rate of the agriculture sector is higher than the average national level.

- The main agricultural products exported from Vietnam were produced in the MD.

- The economic structure of the MD is presently moving towards the industry and service sectors and away from the agriculture sector

- In the internal economic structure of agriculture sector, crops and livestock-aquaculture dominated the sector with more than 72 percent and 10 percent, respectively. The agricultural services sector contributed the smallest share of less than 8 percent.

These findings show that in order to develop the agricultural economy of the Delta, a transfer toward the production sectors that are able to create more value-added services needs to occur

The agricultural sectors contribution to regional GDP remains high at 45 percent. This shows that the growth of agricultural sector has a large effect on the economic development of the Delta. Additionally, the contribution of the regional agricultural sector to the national agricultural sector has declined. This leads to a questioning about the Delta's future as a leading agricultural producer.

Other than rice and aquaculture, other crops such as maize, cereals, vegetable, fruit, and perennial crops are specialty agricultural products in the MD. These products are found in most of provinces of the Delta. Establishing specialization

areas for these products would take advantage of the regions resources to diversify agricultural production activities.

However, it is important to consider the environmental impacts including the exploitation of natural resources of development. The MD's core sectors of rice production and aquaculture culturing are major culprits in the destruction of ecology systems. For example, transferring rice area to aquaculture production reduces wetland area and destroys the coastal forests and the new "rice-shrimp system" farming model has led to increased salinity in the rice fields. An ideal model needs to take into consideration any environmental impacts.

In movement towards a new agricultural economy, the following is recommended:

1. The economic structure of the agriculture sector needs to be changed with agricultural services and livestock sectors the priority sub-sectors. A strategy for aquaculture development should carefully take into account any negative environmental impacts. Further research on the environmental impacts of aquaculture production systems should be conducted such that the efficiency of the model can be measured.

2. The old rice farming system that exploits soil fertility with three annual crops needs to be re-examined. The negative environmental impacts such as soil erosion and water shortages for competing crops – especially in the dry season – needs to be evaluated in further research.

3. The decline of the MD's contribution to the national agricultural sector creates doubts about the future role of the Delta as the leading agricultural production region in the country. Any future research should focus on agricultural development in the context of both the region and the country.

4. Research on the specialization of key agricultural products and the market for these products is necessary to identify limitations to development as well as the sector's potential.

# REFERENCE

Anh, DT., Thinh, LD., Binh, VT. *Enhancing Sustainable Development of Diverse Agriculture in Viet Nam*. CAPSA working paper No 86**.** The United Nation (ESCAP).

Binh N.T. *Diversification development of agricultural production based on sensible exploitation of natural resources and environment protection in the mekong river delta region.* Sub- NIABB, 2002.

Chi P.D, Son D.K, Binh T.N, and Trien N.T. *What to Do for Vietnam Rural?* HCMC Publisher, 2003.

Dwayne Benjamin, Loren Brandt (University of Toronto). *Agriculture and Income Distribution in Rural Vietnam under Economic Reforms: A Tale of Two Regions.* World Bank project investigating the impact of economic reforms on households in Vietnam. 2002.

Dung V.H. *Structural Change of the Mekong Delta Economy*. Journal of Economic Study, pp. 50-62, 2003.

Luat, NV. *Crop diversification in Viet Nam*. Cuulong Delta Rice Research Institute, 2002.

Nam N.V. *Markets for Agricultural Products and Price Uncertainty Control*. Statistic Publisher. 2005.

Pedro Estellès. *Sustainable Development in the Mekong Delta, Viet Nam.* Published by Afdeling for Miljøstudier/Center for Environmental Studies, June 2002.

Quoc Thang, *Mekong river delta develops as key economic development region.* 2006. Available in http://www.tosercohanoi.com/

Statistic Offices of Can Tho city. *Socio-economic statistics of Mekong Delta.* 2005 and 2001.

Tan P.S. *Current status, potentials and solutions for increasing farmers' income from planted area.* Cuu Long Delta rice research institute, 2000.

The Ministry of Agriculture and Rural Development (MARD). *Master plan of the MD's Agriculture in period of 2000-2010.* Report 2003.

The Sasakawa Peace Foundation of Japan. *Agricultural Development in Vietnam Economic Zones.* Agriculture Publish House, 2003.

# APPENDIX

**Appendix 1:**    **Maize specialization index in the MD, 2000-2004**

| Province | 2000 | 2001 | 2002 | 2003 | 2004 |
|----------|------|------|------|------|------|
| Can Tho | 0.49 | 0.37 | 0.45 | 0.41 | 0.36 |
| Hau Giang | 0.52 | 0.34 | 0.49 | 0.76 | 1.12 |
| Long An | 0.18 | 0.95 | 0.76 | 0.87 | 0.61 |
| Tien Giang | 1.62 | 0.98 | 1.02 | 1.01 | 1.21 |
| Ben Tre | 1.12 | 1.24 | 1.22 | 0.73 | 0.76 |
| Dong Thap | 1.37 | 1.11 | 1.34 | 1.43 | 1.28 |
| Vinh Long | 0.69 | 0.63 | 0.82 | 0.60 | 0.49 |
| Tra Vinh | 2.11 | 1.84 | 2.00 | 2.46 | 2.26 |
| An Giang | 2.52 | 2.61 | 2.29 | 2.23 | 2.22 |
| Kien Giang | 0.02 | 0.01 | 0.08 | 0.03 | 0.01 |
| Soc Trang | 1.46 | 1.27 | 1.01 | 0.64 | 0.94 |
| Bac Lieu | - | 0.19 | 0.18 | 0.26 | 0.37 |
| Ca Mau | 0.25 | 0.30 | 0.39 | 0.39 | 0.19 |

Appendix 2:    Cereals specialization index in the MD, 2000-2004

| Province | 2000 | 2001 | 2002 | 2003 | 2004 |
|----------|------|------|------|------|------|
| Can Tho | 0.10 | 0.07 | 0.06 | 0.07 | 0.07 |
| Hau Giang | 0.35 | 0.46 | 0.19 | 0.30 | 0.45 |
| Long An | 0.49 | 0.43 | 0.42 | 0.76 | 0.48 |
| Tien Giang | 0.76 | 0.40 | 0.35 | 0.33 | 0.41 |
| Ben Tre | 1.20 | 1.46 | 1.64 | 1.33 | 1.11 |
| Dong Thap | - | - | - | - | - |
| Vinh Long | 2.51 | 3.05 | 3.87 | 3.61 | 5.12 |
| Tra Vinh | 2.54 | 2.63 | 2.41 | 2.03 | 2.46 |
| An Giang | 2.21 | 1.95 | 1.60 | 1.91 | 0.39 |
| Kien Giang | 0.55 | 0.75 | 1.04 | 0.53 | 1.10 |
| Soc Trang | 1.06 | 1.00 | 0.98 | 1.26 | 1.61 |
| Bac Lieu | - | - | 0.78 | 0.95 | 0.97 |
| Ca Mau | 1.67 | 2.05 | 0.90 | 1.22 | 1.44 |

Appendix 3: Vegetable specialization index in the MD, 2000-2004

| Province | 2000 | 2001 | 2002 | 2003 | 2004 |
|----------|------|------|------|------|------|
| Can Tho | 1.06 | 0.78 | 0.84 | 0.66 | 0.64 |
| Hau Giang | 0.87 | 0.82 | 0.77 | 0.87 | 0.88 |
| Long An | 0.62 | 0.44 | 0.85 | 0.91 | 0.72 |
| Tien Giang | 2.37 | 1.82 | 1.60 | 1.90 | 2.27 |
| Ben Tre | 1.39 | 1.34 | 1.12 | 1.04 | 0.90 |
| Dong Thap | - | - | - | - | - |
| Vinh Long | - | - | - | - | - |
| Tra Vinh | 2.35 | 1.88 | 2.05 | 1.99 | 2.23 |
| An Giang | 1.73 | 1.61 | 1.45 | 1.38 | 1.28 |
| Kien Giang | 0.11 | 0.11 | 0.16 | 0.12 | 0.11 |
| Soc Trang | 1.84 | 1.82 | 1.72 | 1.82 | 1.98 |
| Bac Lieu | - | 1.72 | 1.88 | 1.91 | 2.17 |
| Ca Mau | 0.76 | 1.31 | 0.88 | 0.91 | 0.94 |

Appendix 4: Perennial specialization index in the MD, 2000-2004

| Province | 2000 | 2001 | 2002 | 2003 | 2004 |
|----------|------|------|------|------|------|
| Can Tho | 0.33 | 0.33 | 0.33 | 0.50 | 1.21 |
| Hau Giang | 3.35 | 2.35 | 2.32 | 2.43 | 2.01 |
| Long An | 2.41 | 2.79 | 4.04 | 2.70 | 2.17 |
| Tien Giang | 0.09 | 0.05 | 0.04 | 0.08 | 0.11 |
| Ben Tre | 3.73 | 3.31 | 3.19 | 3.14 | 2.82 |
| Dong Thap | 0.45 | 0.62 | 0.70 | 0.76 | 0.99 |
| Vinh Long | 0.43 | 0.44 | 0.41 | 0.40 | 0.49 |
| Tra Vinh | 1.09 | 1.35 | 1.41 | 1.57 | 1.47 |
| An Giang | 0.28 | 0.38 | 0.32 | 0.29 | 0.33 |
| Kien Giang | 0.37 | 0.34 | 0.35 | 0.34 | 0.26 |
| Soc Trang | 1.18 | 1.34 | 1.38 | 1.34 | 1.23 |
| Bac Lieu | - | 0.32 | 0.28 | 0.32 | 0.20 |
| Ca Mau | 0.94 | 1.44 | 1.15 | 1.12 | 0.92 |

Appendix 5: Fruit specialization index in the MD, 2000-2004

| Province | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| Can Tho | 1.53 | 1.31 | 1.24 | 1.33 | 1.24 |
| Hau Giang | 1.55 | 1.52 | 1.63 | 1.53 | 1.52 |
| Long An | 0.15 | 0.14 | 0.23 | 0.15 | 0.15 |
| Tien Giang | 2.82 | 2.23 | 1.99 | 2.53 | 3.16 |
| Ben Tre | 5.03 | 5.17 | 5.21 | 5.37 | 5.45 |
| Dong Thap | 0.93 | 0.89 | 0.83 | 0.79 | 0.76 |
| Vinh Long | - | - | - | - | - |
| Tra Vinh | 1.14 | 1.09 | 1.10 | 1.13 | 1.09 |
| An Giang | 0.30 | 0.29 | 0.27 | 0.26 | 0.24 |
| Kien Giang | 0.49 | 0.42 | 0.48 | 0.42 | 0.39 |
| Soc Trang | 0.79 | 0.82 | 0.94 | 0.96 | 1.05 |
| Bac Lieu | 0.54 | 0.48 | 0.45 | 0.26 | 0.30 |
| Ca Mau | 0.79 | 1.32 | 0.63 | 0.71 | 0.88 |

# AGRICULTURAL DEVELOPMENT AND NATURAL RESOURCE DEGRADATION: AN ENVIRONMENTAL REVIEW

**Ngo Thi Thanh Truc**
**Bui Van Trinh**
**Vo Thanh Danh**

# 1. INTRODUCTION

The Mekong Delta (MD) is the southernmost region of Vietnam and belongs to the lower Basin of the Mekong River. The whole area is a peninsula with three sides abutted by Cambodia to the North; the East Sea to the East and South; and the Thai Gulf to the South West. In 2004, the MD comprised twelve provinces and one city with a natural area of 39,738.7 $km^2$ (12% of the entire area of Vietnam) and 17.076 million people (20% of Vietnam's population) (General Statistic Office (GSO), 2005).

It is stated the MD has a comparative advantage in various agricultural products relative to other economic zones in Vietnam (SPF et al, 2006). The MD is considered Vietnam's 'rice bowl' with more than 18.5 million tons of paddy rice produced in 2004, which accounted for more than 50% of total national paddy rice production. In 2004, the level of rice exports in Vietnam was 4.5 million tons of which, more than 90% came from the MD. Aquaculture is another major sector in the MD. The aquaculture area of the MD in was 650 thousand ha, more than twice that of 1995. Shrimp production in the MD was 290.2 thousand tons, accounting for 79.5% of national shrimp production (GSO, 2005).

In 2005, the MD suffered many typical environmental problems such as those caused by flooding, water degradation, reduced soil and forest resources and pollution of both urban and rural areas. Of these issues, the reduction of forest, soil and water resources and agro-chemical application were considered the four main issues in relation to agricultural development in the MD.

In recent years, aquaculture development has destroyed forest and coastal areas and rice expansion has narrowed inland forests and wetlands. Soil area in the MD has been exploited to increase agricultural land area. Excess use of modern inputs in agriculture production – such as fertilizers and pesticides – has caused pollution in soil and water resources. The exploitation of forests, land and water resources as well as the use of agro-chemicals threaten economic development – Particularly in agriculture, sustainable resource management and the environmental protection of the MD.

The paper aims to review the environmental impacts of forest, land and water resource utilization as well as the application of agro-chemicals (fertilizers and pesticides). The specific objectives are:

- To evaluate the current situation as well as the problems associated with forest, soil and water resource utilization and agricultural production activities;
- To evaluate the environmental impacts of applying agro-chemicals (fertilizers and pesticides) in the agricultural production; and

- To identify issues for further research in the field of environmental economic analysis.

The data used in this study come from three main sources: Statistics of the General Statistics Office of Vietnam (GSO), Annual reports of the State of the Environment from provinces in the MD and Vietnam, and related existing literature.

All relevant information is presented according to the structure of forest, land use and water utilization as well as agro-chemical application. That is, it was identified how and why the region was different from other time periods or other regions in Vietnam as well as the corresponding impacts. Next, the main problems of utilization and management were reviewed, including discussion on the causes and effects of these problems. Finally, recommendations for sustainable use and management were identified as well as issues for further research.

This paper comprises four sections with each section describing the current situation and problems relating to the resource exploitation. Section 1 presents the current status of forests in the MD and problems relating to forest protection and development. Section 2 describes the characteristics of soil and land use in the MD – specifically land used for agriculture and aquaculture production – and problems relating to soil exploitation and land use management. Section 3 presents the characteristics of water resource use in the MD and problems relating to water use and management. Section 4 describes the current use of agro-chemicals, the reported impacts from agro-chemicals and problems of management. Finally, conclusions and recommendations are drawn from the four sections and further research is identified.

The scope of this paper is limited to the impacts of agriculture on forests, land and water resources in the MD. The impacts of industrial ande service sectors have not been examined in any detail.

## 2.  FOREST USE AND MANAGEMENT

Firstly, this section presents the current status of forests in the MD. This includes:
- Forest cover;
- Types of forest i.e. natural and planted forests, *Melaleuca* and mangrove forests, protected forests, special use forests and production forests;
- Forest distribution by province;
- Causes of low forest cover and unbalance distribution;
- The state of wetlands and their importance to forest protection in the MD as well the impacts of wetland loss.

54

Secondly, the three most critical problems threatening forest production and development in the MD will be elicited.

*Current status of forest in the MD*
Table 1 shows that in 2004, total forest area in the MD was 334.8 thousands hectares accounting for only 2.8% of total forest area in Vietnam. The percentage of forest cover in the MD was 6%, the lowest of all regions in Vietnam (the national percentage was 36.7% in 2004). 85.3% of forest in the Mekong Delta was plantation forest (285.5 thousand ha) compared with the national level of only 18.6% (GSO, 2005). This low level of forest cover in the MD is due to deforestation during the war and, in the last decade, the conversion of forest area to rice fields, saltpans and shrimp ponds (Tong P. H. S. et al, 2004; Miller F. et al, 1999; Hotspot Mekong Delta-soils).

**Table 1: The forest area in Vietnam and the Mekong Delta in 2004**
**Unit: Thousand ha**

| Type of forest | Vietnam | | Mekong Delta | |
|---|---|---|---|---|
| | **Area** | **%** | **Area** | **%** |
| **Natural area (km$^2$)** | 329,314.5 | | 39,738.7 | |
| **Forest area** | 12,173.3 | | 334.8 | 2.8 |
| **Forest cover (%)** | | **36.7** | | **6.0** |
| Natural forest | 9,904.0 | 81,4 | 49.3 | 14,7 |
| Planted forest | 2,269.3 | 18,6 | 285.5 | 85,3 |

*Source: GSO, 2005. The data was accounted to 31/12/2004*

There are two main forest ecosystems in the MD these are *Melaleuca* and mangrove forests. *Melaleuca* forests are located mainly in the Plain of Reeds, the Long Xuyen Quadrangle and the Ca Mau Peninsula area. In 2004, these forests contributed 63% of the total forest area in the MD. Mangrove forests (i.e. *Rhizophora apiculata, Avicenia spp.*, etc) are located in coastal wetlands and account for 37% of the total forest area in the MD (Thanh N. C., 2005).

Mangrove forests play an important role in coastal protection. Despite this, since 1950 more than 70% of mangrove area has been destroyed (There was approximately 250,000 ha of mangrove forest in the MD in 1950 – Sub-FIPID cited from Miller F et al, 1999). This destruction is largely due to war, overcutting for timber, charcoal making, wood for fuel as well as fishery and aquaculture exploitation.

Forests in the MD can be divided by function into three categories – protection, special use and production. Protection and special use forests equally occupy approximately 42% of total forest area in the MD. They are located in coastal and wetland areas and as well as 10 protected sites (Appendix 1). Production forests contribute the remaining 58% of total forest area (Binh N. N., 2003).

Plantation forests have increased steadily in recent years with the support of a national 5 million ha plantation program (Binh N. N; GSO, 2005). In Ca Mau,

Bac Lieu, Soc Trang and Tra Vinh, the Coastal Wetland Protection and Development Project – funded by World Bank, DANDA and the Vietnamese government – supported the reestablishment of the forest belt for coastal areas (see Appendix 2 for further information on forest plantation from 1995-2000 in the MD).

Total forest area differs significantly among provinces in the MD (Table 2) with Ca Mau (97.2 thousand ha), Kien Giang (95.7 thousand ha) and Long An (70.1 thousand ha) occuping 78.6% of total forest area in the MD in 2004. Natural forests are located mainly in Kien Giang with 45.7 thousand ha (92.7% of total natural forests in the MD) and plantation forests are chiefly in Ca Mau and Long An. There was no forest area in Vinh Long and Can Tho city. The difference in forest distribution is caused by the natural characteristics of the Delta as well as varying human activities.

**Table 2:    Forest area by provinces in the Mekong Delta in 2004**
**Unit: thousand ha**

| Provinces/City | Total | | Natural forest | | Plantation forest | |
|---|---|---|---|---|---|---|
| | Area | % | Area | % | Area | % |
| Long An | 70.1 | 20.9 | 0.8 | 1.6 | 69.3 | 24.3 |
| Tien Giang | 12.0 | 3.6 | 0.3 | 0.6 | 11.7 | 4.1 |
| Ben Tre | 3.8 | 1.1 | 0.9 | 1.8 | 2.9 | 1.0 |
| Tra Vinh | 8.4 | 2.5 | 0.9 | 1.8 | 7.5 | 2.6 |
| Đong Thap | 11.0 | 3.3 | - | - | 11 | 3.9 |
| Vinh Long | - | - | - | - | - | - |
| An Giang | 14.3 | 4.3 | 0.6 | 1.2 | 13.7 | 4.8 |
| Kien Giang | 95.7 | 28.6 | 45.7 | 92.7 | 50 | 17.5 |
| Hau Giang | 2.1 | 0.6 | - | - | 2.1 | 0.7 |
| Soc Trang | 14.4 | 4.3 | 0.1 | 0.2 | 14.3 | 5.0 |
| Bac Lieu | 5.8 | 1.7 | - | - | 5.8 | 2.0 |
| Ca Mau | 97.2 | 29.0 | - | - | 97.2 | 34.0 |
| Can Tho | - | - | - | - | - | - |
| **The Mekong Delta** | 334.8 | 100.0 | 49.3 | 100.0 | 285.5 | 100.0 |

*Source: The General Statistics Office, 2005. The data was accounted to 31/12/2004.*

Wetlands also play an important role in protecting forests in the MD. However, the wetland environment has been seriously degraded. According to Ni D.V, 2000, cited by Torell M. and Salamanca A.M., 2003, there are two categories of wetlands in the MD (1) inland wetlands and (2) coastal wetlands. The inland wetlands are establised as floodplain wet rice, seasonally flooded grassland, and *Melaleuca* forests. The coastal wetlands include mangrove forest areas. The environmental state of wetlands in the MD has seriously deteriorated by over-exploitation in agricultural production activities. Agricultural intensification in rice production and aquaculture are the major contributors to environmental change in the wetlands in the MD. In a WWF report (2001), Baltzer et. al. cited by Torell M. and Salamanca A.M., 2003, stated that "the wetlands of the MD

were once extensive and varied. Today, much of the Delta has lost its natural habitat, although remnants of the once extensive peat swamp forests, freshwater forests and flooded grasslands are represented in these wetlands. As the last representation of these significant habitats, important for distinctive plant communities, threatened bird communities and other significant animals, conservation efforts are now highly critical and are urgent priorities."

Repeatedly, the two main causes of deteriorating the environment of wetland ecosystem are agricultural intensification – mostly in rice production development – and aquaculture production – mostly in shrimp aquaculture. The region has pushed rice volume through increasing cultivation area, where a large source of this additional rice field area came from wetland areas, particularly since 1990. Increasing the rotation of annual rice crops requires the construction of complete irrigation systems particularly in immense wetland areas, such as the Plain Reeds and Long Xuyen Quadrangle where an irrigation system has been built for the reclamation of acid sulfate soil areas. Consequently, there has been a remarkable transformation from broad grasslands to rice fields during this period (Koji 2001, cited by Torell M. and Salamanca A.M.).

Aquacultural production has caused environmental impacts such as saline intrusion of rice-shrimp fields and the neighbouring rice-monoculture fields, sedimentation in rice-shrimp fields, and the disappearance of mangrove forests. Table 3 shows the environmental impacts of shrimp culturing on mangrove forests in the MD.

**Table 3: Environmental impacts of extensive shrimp culture on mangrove forests in the MD**

| Environmental impact | Specific detail |
|---|---|
| Coastal erosion | Increased coastal erosion in Tien Giang, Ben Tre, Vinh Long, Tra Vinh, Ca Mau, and Bac Lieu provinces |
| Salinity intrusion | Removal of mangrove has led to increased vulnerability to storm damage and saline intrusion. |
| Shrimp post-larvae | Declining availability of post-larvae has resulted in decreased yields from extensive shrimp ponds. |
| Mud crab *Scylla serrata* abundance | Mud crabs are an important export crop, relying on mangrove habitats. The populations are reported to be declining, a combination of over-exploitation and habitat loss. |
| Acidification of pond water/soils | Removal of mangroves from extensive shrimp ponds has led to declining yields of shrimp. |
| Declining shrimp pond yields | Related to the decrease in shrimp larval abundance and deteriorating habitat, pond yields have decreased. |

*Source: Phillips 1998, cited by Torell M. et al., 2003*

**Environmental problems of forest protection and development in the MD**
According to the forest development strategy toward 2010 for the Mekong Delta, forest cover will be increased to 14% of the MD's natural area (Thanh N. C., 2005). To achieve this goal, and to protect the existing forest, the MD is confronted with three main problems in forest protection and development: 1) threats of economic development, population pressure and poverty 2) forest fire and 3) institutional arrangements.

**Table 4: Environmental problems of forest protection and development in the MD**

| No. | Problems | Cited source |
|---|---|---|
| 1 | The economic development, population pressure and poverty | - FAO, 2002;<br>- Minh L. Q., 2001;<br>- Sai Gon Economic News, vol. 40, 2005;<br>- State of Environment of Bac Lieu, Tra Vinh and Kien Giang, 2002-2004;<br>- Thanh N. C., 2005;<br>- Thinh P. T., 2003;<br>- Torell M., and Salamanca A.M., 2003. |
| 2 | Forest fire | - GSO, 1995-2004;<br>- Nam M. V. et al, 2003. |
| 3 | Institutional arrangement | - FAO, 2002;<br>- Minh L. Q., 2001;<br>- Nang D., 2003;<br>- Thien N. H., 2005;<br>- Thanh N.C., 2003;<br>- Thanh N. C., 2005. |

**Economic Development, Livelihood and Poverty.**
Economic development, livelihood and poverty are considered problems of most concern in forest protection and development in the MD (FAO, 2002; Thanh N. C., 2005; Thinh P. T., 2003; Torell M., and Salamanca A.M., 2003). Wetland areas are being affected by the rapid growth in aquaculture in the MD, especially in coastals area. In Ca Mau and Tra Vinh, more than 60% of the mangrove forests have disappeared for shrimp expansion over the last 40 years – particularly in the last two decades.

During this period, farmers shifted from mangrove forests to shrimp ponds without the approval of local authorities. The shifts occurred primarily in Ben Tre, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau and Kien Giang Provinces leading to pressure on local authorities to implement land-use planning and forest

58

protection. According to the Report of the State of Environment in Bac Lieu, Kien Giang Tra Vinh, aquaculture area in Bac Lieu increased 33,200 ha from 2001 to 2002. In Kien Giang, shrimp-farming area was 51,044 ha in 2003 – an increase of 34.4% compared to 2002. In Tra Vinh, farmers did not honor contracts with authorities to plant existing forest area with 60% forest and 40% aquaculture. Consequently, shrimp farms in many districts in Tra Vinh have replaced nipa palms. These activities threaten the remaining forest area in coastal areas, which affects both people in the region and the coastal ecosystem. In inland areas, *Melaleuca* forest plantation has developed in Long An, Dong Thap, Tien Giang, An Giang and Hau Giang provinces. *Melaleuca* forests are planted on acid sulphate soil and unfertile soil, an activity that contributes to the increased household income and forest cover in these areas. Most of the *Melaleuca* forests in Long An, Dong Thap, Tien Giang are production forests. In these forests, farmers who plant the trees have the right to cut or harvest them. In 2005, farmers cut thousands of ha *Melaleuca* forests as the price of *Melaleuca* decreased, despite of the actions of scientists and government staff who tried to convince farmers to reduce cutting in order to maintain the forests in these areas (Sai Gon Economic News, vol. 40, 2005).

In 2004, 30% of people in the MD were considered poor, with the majority living in forest areas and relying on forest resources (firewood, fish, wild animal, vegetation, etc.) for their livelihoods (Thanh M. C., 2005; FAO, 2002). Consequently, local authorities are challenged to protect forests in order to improve the living standard of the poor.


**Forest Fire.**

Forest fire is another significant problem in forest protection and development in the MD. In 2002, a substantial forest fire in U Minh Thuong (Upper U Minh) National Park, Kien Giang Province, destroyed more than 4,000 ha of *Melaleuca* forests (40% of the total area of U Minh Thuong) and 194 ha of peat land. In addition, over 2,100 hectares of peat soils were partially burned, leaving only about 600 ha unaffected (Nam M. V. et al, 2003). Another large fire in U Minh Ha (Lower U Minh), Ca Mau Province, burned 4,423 ha of forest in the same year (17% of the total forest area of U Minh Ha).

Many solutions to prevent forest fire in the MD have been implemented – such as forecasting, changed water management mechanisms and education programs to increase local awareness of forest fires. However, forest fire management strategies created other problems involving water management, forests, wetland habitat, etc. Until recently, forest fire has still been a large problem in the protection of *Melaleuca* forests (See Appendix 3 for further figures from 1995 to 2004).

**Institutional arrangement**.

Finally, insufficient institutional arrangements are also a problem for forest protection and development in the MD. Information related to forest use and management – particularly wetland information – is either missing or limited. Data on composition, structure and process including hydrolocial, soil chemistry, flora and fauna and fire process data are not well understood. For example, the hydrology and fire ecology of U Minh Thuong and Tram Chim peatlands are very different, even more so than those in upland areas. For appropriate management this information needs to be better understood. Further more, socio-economic and biodiversity values of wetlands are not well understood and consequently not recognized in development policies – in particular information relating to the total value of the forest wetland ecosystem in the MD; the poor's reliance on forest and wetland resources; and policies for forest and wetland protection and management (Thien N. H., 2005).

In the forest and forest product processing industies there exists investment scarcity. (FAO, 2002). There is also a need for a wetlands management institution and increased knowledge of authorities in relation to forest and wetland protection such that they are able to assist the MD in forest conservation and development (Nang D., 2003; Thanh N. C., 2005).


# 3.   LAND USE AND MANAGEMENT

The first part of this section will present the current status of land use in the MD. In particular, the characteristics of soils, sub-regional divisions by geological structure and surface landscape, types of ecosystems in the MD based on population, settlements, agriculture, land use and types of natural resources, land use for rice production, and the changes of agricultural land for rice and shrimp development in the MD. The second part will elicit the three most important problems that threaten the sustainable use and management of land resources in the MD.

## 3.1 Current status of land use in the MD

### 3.1.1.   Types of soils and land uses in the Mekong Delta

There are three main types of soil in the MD (alluvial, acid sulphate and saline soil) (Torell M. and Salamanca A.M., year, 2003). Alluvial soils, which are agiculturally productive, are usually located along main rivers and cover 31% of the total area in the delta. Acid sulphate soils, which are highly acidic and have low fertility, cover around 41% of the total area in the delta. This type of soil is located in the Plain of Reeds, Long Xuyen Quadrangle and Ca Mau Peninsula. Saline soil, which has limited use, cover 19% of the total area in the delta and are located along coastal areas. The saline levels are due to salt-water intrusion

from December to May when the water table is low, rainfall is less and the tidal regimes from the Gulf of Thailand and the South China Sea push saltwater upstream. In the past 30 years, saline and acid sulphate soils have been exploited for agricultural development.

The MD can be divided into five sub regions based on geological structure and surface landscape features – the Plain of Reeds, Long Xuyen Quadrangle, the Central Area, the Eastern Coastal Area and Ca Mau Peninsula (Torell M, and Salamanca A.M., 2003). The Plain of Reeds is located on the northern bank of the lowest depressions in the hinterland, consisting of three provinces Long An, Dong Thap and Tien Giang (50% of its area located in the Long An province). This region is commonly flooded in the wet season. The Long Xuyen Quadrangle is located on the northwestern bank of the Bassac River comprising An Giang, Kien Giang, a part of Can Tho City, together with the archipelagoes of Phu Quoc, and Nam Du. This region consists primarily of acid sulphate soil and salty acid sulphate soil. In the wet season, it is flooded to a large extent for 1.5-2 months. The Central Area of the MD is the largest sub-region of alluvial soil, which is used to grow rice and fruit gardens, it is also most developed economy in the MD. The Eastern Coastal Area is located broadly in the coastal plain from Go Cong, Ben Tre, Vinh Long, Soc Trang and Bac Lieu. This region has many sand dunes along the coastline. Ca Mau Peninsula located in the southern part of the delta and comprises Kien Giang and Ca Mau.

Basing on population, settlements, agriculture, land use and types of natural resources, there are three main types of ecosystems in the Delta: Towns and cites; agricultural land and natural or semi-natural wetlands. Towns and cites cover 7% of total land areas in the MD. Agricultural land constitutes 83% of the area and is home to 79% of the population while urban areas occupy 10% of the areas and comprise 30% of the population (Ni D. V. cited by Torell M, and Salamanca A.M., 2003).

There are three land types used for rice production in the Mekong Delta. These are rice cultivated with fresh water irrigation (which yield three crops per year), rice cultivated in relatively dry areas (one crop per year) and rice cultivated in the wet areas (two crops per year). The majority of rice grown in the MD is cultivated with fresh water irrigation whereas the second most common land use is traditional rice varieties. Since economic reforms, agricultural practices and cropping patterns have changed rapidly. Environmental factors such as flooding and salinity have prevented rice production. However, artificial constructions such as dams, dykes and canal systems have helped to increase the annual number of rice crops.

### 3.1.2. Trend of change in land uses

**Table 5: Agricultural land changes from 1977 to 2003**
**Unit: Thousand ha**

|                                    | 1977    | 1980    | 1985    | 1990    | 1995    | 2003*   |
|------------------------------------|---------|---------|---------|---------|---------|---------|
| Total area of the MD               | 4,013.6 | 3,987.6 | 3,965.8 | 3,957.2 | 3,955.5 | 3,973.9 |
| Agricultural land                  | 2,239.4 | 2,541.0 | 2,435.3 | 2,462.3 | 2,612.2 | 2,960.5 |
| % Agricultural land/Total area (%) | 55.8    | 63.7    | 61.4    | 62.2    | 66.0    | 74.5    |

*Source: Xuan V. T. and Matsui S., 1998; * GSO, 2005*

The intensification, reclamation and irrigation of agriculture has lead to rapid change in land use. Table 5 shows that agricultural land increased from 2,239.4 thousand ha (55.8%) to 2,960.5 thousand ha from 1977 to 2003. The reclamation and irrigation works transformed forest, bare and uncultivated land into agriculture land.

Rice land has increased by 100 thousand hectares annually during 1990-1999. In 2004, total rice field area was 2.1 million ha (3.8 million ha of cultivated area), equal to 50% of national rice field area (GSO, 2005). Increased land use for agricultural production has helped the delta become the most important food-producing region in Vietnam. Triple irrigated rice in the Delta increased significantly during 1985-2000 (Appendix 7) and is expected to increase further in flood areas where dykes are being constructed.

Along the coastline, there has been a conversion from rice fields to shrimp ponds, which requires a change from fresh to brackish water (Appendix 8). This has occurred in areas such as Ben Tre, Tra Vinh, Soc Trang, Kien Giang and Ca Mau (2.2.2), especially particularly during 2000-2004. From 1995 to 2004, aquacultural area has more than doubled to approximately 650 thousands hectares in the MD (GSO, 2005).

Fish breeding has developed substantially in the MD during 1995-2004, particularly from 1998-2002 in An Giang, Tien Giang, Can Tho, Dong Thap and Vinh Long. In 2004, 433,617 tonnes of fish was produced in the Mekong Delta, accounting for 62% of total fish production in Vietnam. Specifically during this period, An Giang, Can Tho and Tien Giang produced the highest level of output for all regions in the MD (GSO, 2005). Fish production, especially *Pangasius sp.* requires large volumes of water, foodstuff and chemicals, which contribute to disease and pollution in these provinces (Appendix 9).

### 3.2. Environmental problems of land use and management in the Mekong Delta

Most problems associated with land use and management, are caused by the exploitation of problem soils (acid and saline soils) these include threats to soil fertility, management and the lack of integration of land and water use.

**Table 6: Environmental problems of land use adn management in the MD**

| No. | Problems | Cited source |
|---|---|---|
| 1 | The impacts of exploitation of problem soils (acid and saline soils) | - Ecoagriculture Partners- Department of Soil Science, College of Agriculture, Cantho Univeristy, 2004;<br>- White I. et al, 2000;<br>- Minh L. Q., 2001;<br>- Estellès P. et al, 2002 |
| 2 | Threats of soil fertile and management | - Department of Soil Science, College of Agriculture, Cantho Univeristy, 2004;<br>- Khoa L. V, 2002;<br>- Khoa L. V, 2003;<br>- Estellès P. et al, 2002 |
| 3 | Integration management between land and water use | - CAULES, 2005;<br>- Department of Soil Science, College of Agriculture, Cantho Univeristy, 2004;<br>- GSO, 2005<br>- Minh L. Q., 2001;<br>- Populus J. et al, 2002;<br>- Tuyen N. Q., 2004; |

Impacts from the exploitation of problems soil are not simple. Fresh water during flooding is used to flush the acid soil and dams are built to prevent saline intrusion, these activities are conducted for the purpose of rice expansion. As a result, problems arise such as changes in the ecological features of wetlands, soils and aquatic organisms. The complete impact of these problems is not yet fully understood.

Changes in agriculture also threaten soil fertility and increase the speed of soil degradation in the MD. Intensification was introduced to the MD during the 1980s in an attempt to increase food security and to help the MD become the largest rice producer and exporter in Vietnam. In order to increase cultivation area, there has been an increase in soil rotation, inputs, agro- chemicals and the reclamation of problem soils (acid and salty soils). According to Khoa L.V., 2002 and 2003 soil compaction was found to be a physical characteristic of soil degradation, especially in rice monoculture.

The integration of land and water use is extremely important in MD. Changes in land use – especially rice-shrimp (Ca Mau, Bac Lieu, Soc Trang, Tra Vinh, Kien Giang, Ben Tre) and rice-pond (An Giang, can Tho, Tien Giang, Dong Thap, Vinh Long) – have resulted in ecosystem destruction, saline intrusion, salty soil, water shortages in irrigation and pollution (Populus J. et al, 2002).

The impacts of saline intrusion on rice production and the shortage of fresh water supplies in the dry season have become increasingly critical in the floodgate areas of the MD (Tuyen N.Q., 2004; CAULES, 2005). This problem is discussed in further detail in section 4.2.

## 4. WATER USE MANAGEMENT

### 4.1. The current status of water resources in the MD

The MD has a water reserve of 550 km$^3$ and is the most advantageous region in terms of water resources, as it possesses many rivers as well as a large canal network. However, the water supply changes during the rainy season and the dry season. In the rainy season, rivers are rejuvenated with large volumes of rainwater as well as fresh water from the upper Mekong River (located outside Vietnam). This increase in water into the river more than compensates for the volume of water disrecharged into the sea. The abundance of fresh water in the rainy season facilitates agricultural production and more than adequately satisfies water demand in general. In contrast, during in the dry season there is a shortage of water for agricultural, aquacultural and industrial production as well as for domestic use. It is said that if a 20% of the surface water is extracted from the river (equal to 400 m$^3$/second), the reduction in water volume is much more than the water volume supplied by the Mekong River. Consequently, there is salt intrusion, which creates problems for water-supply system in the MD.

Total groundwater reserves are estimated at 92,128,000 m$^3$/day, of which static reserves comprise approximately 82,710,000 m$^3$/day and elastic reserves are around 8,349,000 m$^3$/day. Most groundwater is found in shallow layers from 80-100 m. A 'safe' yield is estimated at 1,069,000 m$^3$/day. Overpumping has caused decreased groundwater reserves in recent years. Surveys show that in the Southwest region of the MD, groundwater is reduced by 0.2 - 0.5m annually (Truong et al., 2004). In other provinces such as the central area of Soc Trang, Bac Lieu and Ca Mau groundwater is reduced by 0.5-1.0 m/year, 1.0-1.5m/year (over the past ten years) and 1.0-2.0 m/year (over the past six years) respectively.

Although water resources in the MD are relatively rich for agricultural production, in recent years there have been unforeseeable changes in the trend of flooding. Rice production has faced irrigated water shortages, particularly during the Spring-Autumn crop. In the future, more attention must be paid to water allocation for competitive crops or else the advantage of abundant water sources will disappear.

### 4.1. Environmental problems of water resource use and management in the MD

In this section, we will discuss the main problems associated with water use and management in the MD. As shown in table 7, these include flood, drought, the conflict between water control and water use and integrated water management.

**Table 7: Environmental problems of water resource use and management in the MD**

| No. | Problems | Cited source |
|---|---|---|
| 1 | The impacts and management problems of drought and flood | - White I. et al, 2000;<br>- Minh L. Q., 2001;<br>- Estellès P. et al, 2002 |
| 2 | Water control and quality | - CAULES, 2005;<br>- DOSTE of Tra Vinh, Soc Trang, Kien Giang and Bac Lieu, 2000-2004 and Can Tho, 2005;<br>- Minh L. Q., 2001;<br>- White I. et al, 2000;<br>- Tuyen N. Q., 2004 |
| 3 | Integrated management | - Minh L. Q., 2001;<br>- Populus J. et al, 2002;<br>- Tuyen N. Q., 2004; |

It is important to note, that the conflict between flood and drought is a typical problem for water management in the MD. Water resources are greatly valued, however, there have also been many problems associated with water resources. The MD often suffers from flood in rainy season and a shortage of fresh water for agriculture in the dry season (particularly for the Summer-Autumn rice crop). To restrain the flood, the Government has built a dyke and flood drainage system into the West Sea. However, these activities have negative impacts on the environment – such as water regimes, soil fertility and socio-economic factors.

Another problem with water resources is water quality and pollution. A huge amount of water comes from outside the Delta. In addition, wastewater from agricultural production, industry and domestic use is discharged back into the river. According to various provinces Report of the State of the Environment of the Department of Environment and Natural Resources, the surface water of the Delta is partially polluted in areas such as residents' clusters as well as industrial, agricultural and aquaculture areas. In recent years, the water quality of rivers, ditches and canals has started to exceed the levels permitted by Vietnamese standards, especially in relation to organic pollution. This problem can only worsen if there is no action to prevent the source of the pollution.

The rivers are being used as sewage systems for all kinds of wastewater. Consequently, organic substances, residue from agri-chemicals, heavy metals and epidemic actors pollute the surface water. In the coastal areas of Ca Mau, Kien Giang, Bac Lieu, Tra Vinh and Soc Trang the source of pollution comes from interior rivers, ditches and canals, water transportation, aquaculture (especially shrimp farming), agricultural activities (fertilizer residues, overuse agro-chemicals, etc.), wastewater from urban areas, resident clusters, and tourism activities along the coastline. The conflict between water use and integrated water management in the MD can only become more critical in the future.

Acid water is another big problem in the Mekong Delta as it affects water quality and subsequently agricultural and aquacultural production. Acid water can be found mainly in acid sulphate soil areas. An additional problem is saline intrustion, which is particularly prevelent during the dry season in Ca Mau, Tra Vinh and Kien Giang (DOSTE of Tra Vinh, Soc Trang, Kien Giang and Bac Lieu in 2000-2004). At the mouth of the Tien River (Tien Giang province), the salt level is approximately 4% and streaches inland around 40-60 km. In April 2003, the salt water in Can Tho City was measured 62 km from the central city. In April 2004, it had reached 30 km from the city and by February 2005 it was only 10 km. In the MD, salt intrusion during the dry season affects agricultural production and consequently the livelihood residents. Some crops, e.g. the Spring-Summer rice production, do not receive enough water to survive. Consequently, the paddy rice areas are reduced in the dry season. Almost all rivers in the MD face the problem of salt-water intrusion and more than 70% of residents are affected.

Integration management of water resources in the MD covers management between provinces in the MD (and other upstream areas) as well as the management between different types of water use (agriculture, aquaculture, domestic and industrial use).

Water management among provinces (up and down stream from the Mekong Basin) in the flood and dry seasons as well as for fresh, brackish and saline water is a big challenge not only for the authorities of provinces in the MD but also for other countries along the Mekong River.


## 5. AGRO-CHEMICAL USE MANAGEMENT

### 5.1. The state of agro-chemical use and management in the MD

In this subsection, we will highlight the general state of agro-chemical use and management in the MD. Recent years have witnessed agricultural change related to the reclamation of saline and acid sulphate soils in Ca Mau, Bac Lieu, Soc Trang, Long An and Dong Thap as well as dyke management in An Giang. As a result of these changes, cultivation has increased from one to two or three

crops annually. This increase in land rotation forces farmers to increase the level of fertilizers and agro-chemicals in order to compensate for nutrient loss from harvest. As monoculture – particularly in rice cultivation – caused a break out of disease, farmers have been urged to use more agro-chemicals. In addition, the development of the aquaculture sector has also increased chemical use and thus polluted the Hau and Tien Rivers. However, the required level of fertilizer and agro-chemicals for domestic use cannot be adequately provided by local production. Therefore, the government has to import fertilizers and agro-chemicals that are not highly controlled. Table 5 presents the importation of fertilizer in Vietnam during 1995-2004. As shown, Urea is the most imported fertilizer and the importation of fertilizer of all types has increased.

**Table 8: Fertilizer import of Vietnam from 1995-2005**
**Unit: Thousand tons**

|  | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| Fertilizers | 2311,0 | 2787,1 | 2526,7 | 3448,0 | 3702,8 | 3971,3 | 3288,2 | 3820,2 | 4135,1 | 4064,8 |
| Of which |  |  |  |  |  |  |  |  |  |  |
| SA |  |  |  |  |  | 436,4 | 390,0 | 549,0 | 509,0 | 671,1 |
| Urea | 1356,2 | 1658,3 | 1480,0 | 1944,0 | 1893,0 | 2108,3 | 1652,0 | 1818,0 | 1926,0 | 1709,5 |
| NPK |  |  |  |  |  | 200,1 | 127,0 | 275,0 | 219,0 | 311,6 |
| DAP |  |  |  |  |  | 591,0 | 574,0 | 613,0 | 767,0 | 596,8 |
| Potas-sium |  |  |  |  |  | 411,5 | 483,0 | 517,0 | 662,0 | 696,3 |
| Others |  |  |  |  |  | 224,0 | 62,2 | 48,2 | 52,1 | 79,5 |

*Source: GSO, 2005*

According to an estimate by an agricultural services company in 2002, the consumption of fertilizers in Bac Lieu is approximately 30,000 tons with 490 tons of agro-chemicals. In reality, the quantities of fertilizers and agro-chemicals is likely to be much higher due to increased cultivation area. Increased fertilizer use creates problems for all provinces in the MD, as a result the departments of agriculture and rural deveeopment and agricultural extensions has launched programs – such as IPM, "3 down, 3 up program" – which aim to encourage farmers to reduce the use of fertilizers and agro-chemicals. These programs, to some extent, not only help minimize production costs but also help reduce the release of residue into the environment.

The Can Tho Department of Rural Development (2004) reported surface water has been tested for the presence of two groups of chemicals: organic clo (Heptachlor, Aldrin, DDE, Dieldrin, Endrine, TDE, DDT) and organic phosphorus (metha Midophos, Methyl Parathion, Dimethroat) in the first two quarters of 2004. Agri-chemicals were detected in surface water samples in numerous areas, particularly in agricultural production areas. Presently, the concentration of these residues is still at an acceptable level – i.e. under the level of WHO, TCVN 5942-1995 and TCVN 6774-2000. Additional to agro-chemicals, DDT was also detected in a couple of water samples, despite the banning of this chemical.

Agro-chemicals do not only pollute water resources, they also pollute soil. The use of agro-chemicals has increased to 450 tons in 2003 (see appendix 3). Soil quality monitoring – in all the sample sites in Cantho – has revealed the presence of agro-chemicals with BHC amounting from 13.33-21.30 ppm, Endosulfan-1 from 12.86-22.25 ppm. However, other substances such as Heptachlor Epoxid, Aldrin, Heptachlor, Dieldrin, Endrin, O,P* DDD, Endosulfan Sulfat, Endrin Aldehyde and Methoxyclor were not detected. Soil quality monitoring of agricultural land in Cantho over many years has found the pollution from agro-chemicals to be on the increase. However, the level of agro-chemical residues in soil in Cantho is still 10 to 100 times below the national average of 5941-1995.

## 5.2. Environmental problems in agro-chemical use and management in the MD

In this subsection, we will discuss the impacts of agro-chemical use on human health, aquatic life, water quality and soil over the past ten years. We will also consider management problems associated with agro-chemicals. Table 9 lists some existing studies on the issue.

**Table 9: Environmental problems of agro-chemical application in the MD**

| No. | Problems | Cited source |
|---|---|---|
| 1 | The impacts of agro-chemical use on human health, aquatic life, water quality and soil | - White I. et al, 2000; <br> - Minh L. Q., 2001; <br> - Dung N. H et al, 1999; <br> - Department of Rural Development of Ca Tho, 2004; <br> - Truc N. T. T, 2005; <br> - Huan N. H., 2001; <br> - Phuong N. M, 2002); <br> - Khoa L. V., 2002 |
| 2 | Poor management | - Department of Environment and Natural Resource Management, 2004 <br> - Huan N. H., 2001 |

**Health risk**
Existing research has found that crops effectively uptake 30% of the total amount of fertilizer used while the rest is either washed off or accumulated in the soil, resulting in environmental contamination. The issue of chemical residues in agricultural products has been the centre of much concern from the public and press as well as scientists. Pesticide poisioning can be attributed to exposure to pesticides, which contaminate workplace, living environment and food (Wheeler D; Dung N. H. et al, 1999).

Dung et all (1997) studied the health consequences of pesticides on rice farmers in the MD. Their results showed that farmers used up to 75 types of fungicides, insecticides and herbicides, of which many fall under the World Health Authority categories I and II – moderately and extremely hazardous. The study also showed evidence of eye, skin, cardiovascular and neurological effects due to pesticide use. Many similtaneously experienced multiple acute poisoning symptoms. More than 95% of farmers thought that the use of pesticides in the long-run would adversely effect their health, yet only 33% used protection equipment such as caps, masks or special clothing when spraying. Cost and discomfort were reported as the main reasons for not using protection equipment. However, health costs incurred by this exposure were estimated to be between 89,310 VND and 94,129 VND per farmer per hectare.

Another study of farmer practice in fertilizers and pesticides in the Tan Thuan commune, Chau Thanh district, Hau Giang province in 2004 (Truc N. T. T, 2005) showed that 53.7% farmers did not use safety clothes when they sprayed pesticides. It also found that the most common symptoms after spraying chemicals were dizzy (48.1%), fatigue (35.2%), shortness of breath (22.2%), vomiting (13.0%) and headaches (9.3%).

It is important to note that the adverse impacts of agro-chemicals are not only imposed on farmers but also on people who consume agricultural products with high concentration of pesticide residue or people who are exposed regularly to pesticides. This group of victims may include producers, traders and farmers' members.

**Aquatic life and water quality**
Impacts of what on the aquatic life and water quality are also considered. Very usually agro-chemicals used for rice and plants are not fully uptaken by plants and soil. The rest of the used agro-chemicals are washed away and probably diluted to creeks, canals and rivers. The hazardous chemicals might accumulate and magnify in aquatic organism and food chain (Huan N. H., 2001; Phuong N. M, 2002). Further more, as lots of people in the MD have habit of using water directly from river, so it is very likely for them to use contaminated water.

**Soil contamination and soil organisms**
Soil contamination and soil organisms are also affected by agro-chemicals. Many scientists have warned farmers of their pesticide using on their farms. The amount of agro-chemicals which is not uptaken by the plants and water, goes to soil and accordingly affects soil condition and soil organism. The other parts will be endosmosis to the groundwater (Huan N. H., 2001; Khoa L. V., 2002).

**Management problems of agrochemicals**
Another problem of agrochemical use is agro-chemical management. Agrochemical management, especially pesticide management covers a wide

range of areas including importation, production, formulation, distribution, marketing, training and safe handling (including the handling of obsolete stocks of pesticides). Prior to the 1990s, pesticide management regulations did not exist in Vietnam. The use of Government subsidies resulted in the importation and distribution of pesticides by state agencies. On average, national pesticide use has annually been between 13,000 and 15,000 tonnes of finished products (including those categorised as extremely or highly hazardous under WHO) . This includes methyl parathion, monocrotophos and methamidophos, as well as the highly persistent DDT and HCH(7) (Huan N. H., 2001).

Since 1990, pesticide management has improved with the introduction of regulation which included the development of an inspection network from central to grassroots level and the presence of a stronger infrastructure for quality assurance. As a result, the number of pesticides on the restricted and banned lists has continuously increased (see appendix 7) and the quantity of restricted pesticides imported has decreased between 1991 and 1998 (see appendix 8). The restriction of highly toxic pesticides in 1994 – such as carbofuran, endosulfan, methamidophos, monocrotophos, methyl parathion and phosphamidon – has reduced the adverse environmental impacts of pesticide use as well as the impacts on community health. Since the ban, the number of cases of food poisoning due methamidophos residue in vegetables has reduced sharply. However, according to two surveys of pesticide use conducted in 2000 – one survey is a comprehensive nation-wide inspection and other studies farmers' confidence, attitude and practices in a safe and effective use of pesticides in the South of Vietnam – retailers and farmers still appear to have poor practices in selling and pesticide use  (see appendix 9 and 10) (Huan N. H., 2001).


# 6.   CONCLUSION AND RECOMMENDATION

In 2004, forest area in the MD comprised 334.8 thousand ha, 6% of the Delta, the lowest figure in Vietnam.  That forest area which still remains is threatened by forest fire, agricultural development, population, a lack of knowledge and poor institutional management.

Approximately 70% of the soil area in the MD is problematic soil (acid sulphate and saline soils). The introduction of reclamation, irrigation and intensification have lead to an increase in agricultural land from 55.8% in 1966 to 74.5% in 2003. At the same time, land use management in the MD faced conflicts of land and water use, soil fertility and degradation and the conservation of wetland plots.

Water resources in the MD create both benefits and constraints. Water resources help to reclaim soil resources as well as to increase the amount agricultural land

in the MD while inherent characteristics– e.g. flooding, drought, water control and integration management – create more challenges for water management. Agro-chemicals are the result of agricultural and aquacultural development in the MD. The use of pesticide and fertilizers has increased in many provinces over time and as a consequence pesticide residue has been found in rivers of the delta. The impacts of agro-chemicals on human health, aquatic life, water quality and soil were reported, however, they are yet to be fully understood. The management of agro-chemicals, especially illegal pesticides, and farm use of agro-chemicals are major concerns in agrochemical management.

Recommendations for further studies relating to environmental economics include:
- A total valuation of forests, wetlands and the contribution forests make to the poor in the MD.
- Cost benefit analysis of land use – such as irrigation and reclamation costs.
- Valuation of water resources in the MD and the environmental impacts of agricultural activities, especially rice, shrimp and fish.
- An assessment of agrochemical impact on humans and aquatic life as well as solutions for better management in agrochemical use.

# REFERENCE

Binh N. N., 2003. *The National Policy to Rehabilitate and Develop 5 Million Hectares of Forests and Other Issues on Wetlands*. Wetland Management in Vietnam: Issues and Perspectives.

Buu B. C., 2005. Seedling Structure of Spring-Winter rice crop 2005-2006 and seedling production system in the Mekong Delta. Institution of Rice Research of Cuu Long Delta.

Can L.T, Phan D.H., and An L.Q. *Environmental Governance in Vietnam in a Regional Context*. Download from http://pdf.wri.org/mekong_governance_mreg_canphanan.pdf

CAULES, 2005. Research Priorites for the Mekong Delta – Environmental Status and Future Requirement.

D., Hung. T. V., Mau P. N., Wil D. J., 2001. *How does Vietnam Rehabilitate its Forests*. Review of Forest Rehabilitation Projects – Lessons from the Past, a project coordinated by CIFOR in Vietnam, Indonesia, China, Philippines and Peru.

Danh V.T. 2005. Groundwater Management at the MeKong Delta. First Draft EEPSEA Report.

Department of Natural Resources and Environment of Can Tho Province. 2004. The State of the environment of Can Tho Province in 2004.

Department of Natural Resources and Environment of Kien Giang Province. 2004. The State of the environment of Kien Giang Province in 2004.

Department of Natural Resources and Environment of Soc Trang Province. 2004. The State of the environment of Soc Trang Province in 2004.

Department of Sciene, Technology and Evironment of An Giang Province. 2003. The State of the environment of An Giang Province in 2003.

Department of Sciene, Technology and Evironment of Bac Lieu Province. 2001, 2002. The State of the environment of Bac Lieu Province in 2001 and 2002.

Department of Sciene, Technology and Evironment of Tra Vinh Province. 2000, 2001, 2002, 2003. The State of the environment of Tra Vinh Province in 2000, 2001, 2002 and 2003.

Dung N. H. et al, 1999. Impact of Agrochemical use on productivity and health. EEPSEA.

Estellès P., Jensen H., Sánchez L., Vechiu G., 2002. Sustainable Development in the Mekong Delta (Soil and Water). Afdeling for Miljøstudier/Center for Environmental Studies.

FAO, 2002. Summary of Major Issues, Development objectives of the Forestry Sector towards the year 2010.

GSO, 2005. Statistical Figures of natural area, population, export, import, forest, land use, rice production, aquaculture and shrimp in Vietnam and the MD from 1995-2004.

Hai H. P. 2000. The irrigation issues relating to clean water supply to the rural areas in 2000-2010 in Tien Giang Province.

Hotspot Mekong Delta-soils. Case study 2: Mekong Delta, Vietnam. Cited from http://www.rrcap.unep.org/lc/cd/html/hotspot/mekong/result1.html

Huan N. H., 2001. *Vietnam promotes solutions to pesticide risks*. Pesticides News No. 53, pages 6-7.

Khoa L. V., 2003. *Soil compaction on rice intensive cultivation in the Mekong Delta, Vietnam.* Scientific review of Cantho University, major of Soil Science and Land Use Management and Environment and Natural Resource Management. P. 93-101 (Vietnamese).

Khoa L.V, 2001. Cantho University, Vietnam Research and Education with the development of Mekong Delta. Cited from www.waterforfood.org/docPresent/downloads/Can%20Tho%20University.ppt -

Khoa L.V., 2002. Physical fertility of typical Mekong delta soils (Vietnam) and land suitability assessment for alternative crops with rice cultivation. *Conservation of the natural land resources of the Mekong delta*. Cited from http://www.innovations-report.de/html/berichte/agrar_forstwissenschaften/bericht-14800.html

Khuyen N.T. 2004. *Agricultural Development in the MD Food Plains*. Economic Development Review. No 122/2004.The Ho Chi Minh City of Economics.

Miller F, Thinh N. V., Duc D. T. M, 1999. Resource Management in the Vietnamse Mekong Basin. Mekong Working Paper No 74.

Minh L. Q., 2001. Environmental Governance: A Mekong Delta Case Study With Downstream Perspectives. Cited from http://pdf.wri.org/mekong_governence_mreg_minh.pdf

Nam M. V, Thao N. V., Nhut Q. M, Thong P. L., 2003. Melaleuca Forest Fire in 2002 in the Mekong River Delta. EEPSEA.

Phuong D M, 2002. *The Impacts Of Pesticide Use In Rice Production On Aquaculture In The Mekong Delta:A Dynamic Model. EEPSEA.*

Populus J., Martin J.L., An N. T. 2002. Shrimp farming sustainability in the Mekong delta. Environmental and technical approaches. Proceedings of the Workshop held in Travinh (Vietnam), 5-8 March, 2002. IFREMER.

Sai Gon Economic News, 2005. Tim loi di cho cay Tram (Vietnamese). Volume 40-2005 (772). Cited from http://www.saigontimes.com.vn/tbktsg/detail.asp?muc=28&sobao=772&sott=25

SPF et al, 2006. Comparative Advantage Studies of the Particular Products in the Ecological Zones of Vietnam. The Agricultural Publishing House.

Sustainable Development in the MD. Download from http://www.environmentalstudies.au.dk/publica/f2002sustainable-in-mekong.pdf

Thanh N. C., 2005. *Forests and Wetland in Mekong Delta*. Workshop "Research Priorities for Mekong Delta - Environmental Status and Future Requirement.

The Impact of Floods, Drought and other Water Disasters on Poverty, the Poor and Gender Equality in the Mekong Delta of Vietnam. Summary Reports of Working Groups

The State of Environment in Vienam 2001. Download from http://www.rrcap.unep.org/reports/soe/vietnam/issues/index.htm in Land use, forest and water pollution.

Thien N. H., 2005. *Wetland Status in the Mekong Delta and Research Priorities*. Workshop "Research Priorities for Mekong Delta - Environmental Status and Future Requirement.

Tong P. H. S., Auda Y., Populus J., Aizpuru M., A. Al Habshi A., Blasco F., 2004. Assessment from space of mangroves evolution in the Mekong Delta, in relation to extensive shrimp farming. Int. J. Remote Sensing. Vol. 25, No. 21, 4795–4812.

Torell M, and Salamanca A.M., 2003. Wetlands Management in Vietnam's MD: An overview of the Pressures and Responses. Download from http://www.worldfishcenter.org/Pubs/wetlands/pdf/Chapter01.pdf

Truc N. T. T., 2005. Environmental Economics in Agricultural Production: Estimating the Environmental Cost of Fertilizers and Pesticides in intensive rice production in Tan Thuan commune, Chau Thanh A district, Hau Giang province, Vietnam. Draft.

Tuyen N.Q, 2004. Discussions on law of water resources in Vietnam (Vietnamese). Download from http://www.ciren.gov.vn/modules.php?name=News&file=article&sid=2825

Water Utilisation in the Lower Mekong Basin. Download from http://www.kellnielsen.dk/mekong/w-uses.htm

Wheeler D. Investigating the Impacts of Pesticide Use in the Mekong Delta. Cited from http://www.idrc.ca/en/ev-5039-201-1-DO_TOPIC.html

White I, Melville M and Summut J., 2000. Possible Impacts of Saline water Intrusion Floodgates in Vietnam's Lower Mekong Delta.

White I., 2002. Water Management in the Mekong Delta: Changes, Conflicts and Opportunities. Technical Documents in Hydrology. No. 61. UNESCO, Paris.

Xuan V. T. and Matsui S., 1998. Development of Farming Systems in the Mekong Delta of Vietnam. Ho Chi Minh Publishing House, Saigon Times Groups,and Vietnam Asia Pacific Economics Center.

# APPENDIX



Đồng bằng Sông Cửu Long/Mekong Delta
An Giang, Bạc Liêu, Bến Tre, Cà Mau, Cần Thơ, Đồng Tháp
Kiên Giang, Long An, Sóc Trăng, Tiền Giang, Trà Vinh, Vĩnh Long
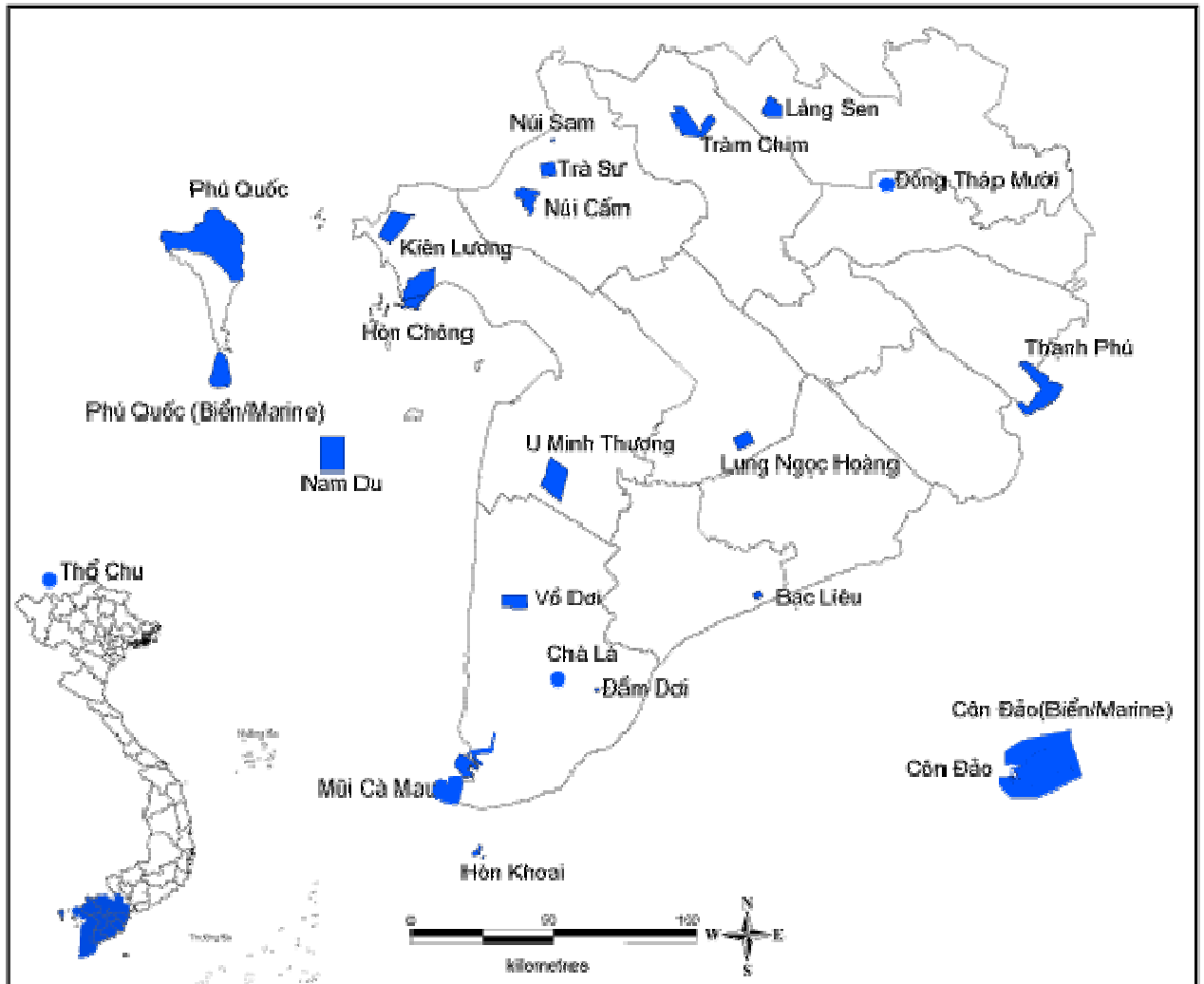
*Source: IUCN*

**Appendix 1: Protected sites in the Mekong Delta**

**Appendix 2: The area of plantation forest from 1995-2004 in the MD.**

*Unit: Thousand ha*

| Province | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004* |
|---|---|---|---|---|---|---|---|---|---|---|
| **The MD** | **39.5** | **24.5** | **27.7** | **21.0** | **17.2** | **18.2** | **20.1** | **22.7** | **25.7** | **21.4** |
| Long An | 0.1 | 1.1 | 2.0 | 2.0 | 3.5 | 6.6 | 6.7 | 7.2 | 7.5 | 5.0 |
| Tien Giang | 0.4 | 0.7 | 0.2 | 0.3 | 0.1 | 0.4 | 0.8 | 1.0 | 1.4 | 1.3 |
| Ben Tre | 0.3 | 0.5 | 0.4 | 0.2 | 0.2 | 0.2 | 0.3 | 0.1 | 0 | - |
| TraVinh | | 0.2 | 0.3 | 0.5 | 0.6 | 0.2 | 0.5 | 0.2 | 0.2 | 0.2 |
| Đong Thap | 0.4 | 0.2 | 0.1 | 0.5 | 0.2 | 0.2 | 0.5 | 0.9 | 0.5 | 0.2 |
| Vinh Long | - | - | - | - | - | - | - | - | - | - |
| An Giang | 0.7 | 1.0 | 2.4 | 2.0 | 1.6 | 1.5 | 1.7 | 1.6 | 1.3 | 0.8 |
| Kien Giang | 26.2 | 9.0 | 13.6 | 5.3 | 2.6 | 3.5 | 4.5 | 5.2 | 7.2 | 6.1 |
| Hau Giang | | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.3 | 0.1 | 0.2 | 0.3 |
| Soc Trang | | 0.9 | 0.6 | 0.7 | 0.6 | 1.0 | 0.6 | 0.5 | 0.4 | 0.5 |
| Bac Lieu | 0.2 | 0.3 | 0.2 | 1.1 | 1.3 | 0.3 | 0.7 | 0.2 | 0.2 | - |
| Ca Mau | 11.2 | 10.5 | 7.8 | 8.3 | 6.5 | 4.3 | 3.7 | 5.7 | 6.8 | 7.0 |
| Can Tho | - | - | - | - | - | - | - | - | - | - |

*Source: GSO, 2005; * Estimated*

**Appendix 3: The destroyed forest area by fire from 1995-2004**

*Unit: ha*

| Provinces | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004* |
|---|---|---|---|---|---|---|---|---|---|---|
| **The MD** | **2,072** | **19.6** | **314.2** | **10,213** | **12.3** | **98.5** | **287.7** | **10,137** | **670** | **1,479.8** |
| Long An | 205 | 2.0 | | 224.0 | | 31.0 | 0 | 1,485 | 99.7 | 452.9 |
| Tien Giang | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 | 0 | 50.0 |
| Ben tre | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0 | 506 | |
| Tra Vinh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | |
| Đong Thap | 37 | 10 | 12 | 9.3 | 2.0 | 4.0 | 0.4 | 7.8 | 7.8 | 5.0 |
| Vinh Long | - | - | - | - | - | - | - | - | - | 13.5 |
| An Giang | 79 | 7.3 | 3.7 | 29.0 | 10.3 | 63.0 | 0.2 | 0.5 | 16.2 | 958.0 |
| Kien Giang | 0 | 0 | 243 | 8,653 | 0 | 0 | 0 | 4,069 | 0 | 958.0 |
| Hau Giang | 0 | 0.3 | 0.5 | 31.0 | 0 | 0 | 0 | 1.8 | 0 | 0.2 |
| Can Tho | - | - | - | - | - | - | - | - | - | - |
| Soc Trang | 8 | 0 | 5.5 | 57 | 0 | 0 | 0 | 0 | 0 | - |
| Bac Lieu | 0 | 0 | 0 | 0 | 0 | 0 | 287 | 0 | 0 | - |
| Ca Mau | 1,743 | 0 | 49.5 | 1,210 | 0 | 0.5 | 0 | 4,423 | 40 | 0.2 |

*Source: GSO, 2005; * Estimated*

**Appendix 4: The destroyed forest areas from 1995-2004 in the MD**

*Unit: Ha*

| Provinces | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004* |
|---|---|---|---|---|---|---|---|---|---|---|
| **The MD** | **2,592** | **6.5** | **454.9** | **312.7** | **15.2** | **205.8** | **110.1** | **571.9** | **41.2** | **34.8** |
| Đong Thap | 200 | 2.0 | 2.3 | 8.6 | 1.0 | 0.1 | 0 | 0 | 0 | - |
| An Giang | 0 | 4.5 | 0.4 | 2.6 | 0 | 0 | 0 | 0.1 | 0 | - |
| Ben Tre | 0 | 0 | 0 | 0 | 0 | 0 | 25.4 | 46 | 6.4 | 9.4 |
| Kien Giang | 0 | 0 | 15 | 0.3 | 0 | 0 | 9.5 | 7.8 | 9.0 | 7.0 |
| Tra Vinh | 0 | 0 | 0 | 0.2 | 0.2 | 0 | 0 | 9.1 | 4.7 | 8.5 |
| Soc Trang | 0 | 0 | 2.2 | 1.0 | 1 | 0 | 3.5 | 3.9 | 1.2 | - |
| Bac Lieu | 0 | 0 | 25 | 0 | 0 | 161 | 55 | 438 | 0 | - |
| Ca Mau | 2,392 | 0 | 410 | 300 | 13 | 44.7 | 16.7 | 67 | 19.9 | 9.9 |

*Source: GSO, 2005; * Estimated*

**Appendix 5: Land use by provinces in the MD in 2003**

*Unit: thousand ha*

| Province | Total area | Of which | | | |
|---|---|---|---|---|---|
| | | Agricultural | Forest | Special use | Residential |
| **Mekong Delta** | **3973,9** | **2960,5** | **371,5** | **246,2** | **100,6** |
| Long An | 449.1 | 323.4 | 58.5 | 30.2 | 11.1 |
| Tien Giang | 236.7 | 179.0 | 12.8 | 17.7 | 7.8 |
| Ben Tre | 232.2 | 167.6 | 6.2 | 11.6 | 7.1 |
| Tra Vinh | 221.5 | 180.0 | 6.1 | 9.9 | 3.3 |
| Vinh Long | 147.5 | 117.1 | 0.0 | 9.5 | 5.0 |
| Đong Thap | 324.6 | 247.8 | 14.6 | 22.4 | 16.6 |
| An Giang | 340.6 | 263.0 | 13.0 | 29.0 | 15.0 |
| Kien Giang | 626.8 | 422.4 | 118.9 | 41.8 | 11.5 |
| Can Tho | 139.0 | 117.0 | 0.0 | 9.4 | 4.7 |
| Hậu Giang | 160.8 | 137.7 | 3.6 | 7.3 | 3.4 |
| Soc Trang | 322.3 | 259.0 | 10.9 | 23.0 | 5.3 |
| Bạc Lieu | 252.6 | 208.8 | 5.4 | 15.5 | 4.0 |
| Ca Mau | 520.2 | 337.7 | 121.5 | 18.9 | 5.8 |

*Source: GSO, 2005*

**Appendix 6: Export output and export turnover of Rice of Vietnam from 1995 to 2005**

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| export outputs (thousand tons) | 1.99 | 3.00 | 3.57 | 3.73 | 4.51 | 3.48 | 3.73 | 3.34 | 3.81 | 4.00 | 4.50 |
| export turnover (million USD) | 530 | 588 | 871 | 1,019 | 1,025 | 667 | 625 | 726 | 727 | 887 | 1,200 |
| Price (USD/ton) | 266.6 | 284.7 | 243.6 | 273.4 | 4.2 | 4,191.7 | 167.5 | 217.2 | 190.7 | 221.7 | 226.7 |

*Source: Buu B.C., 2005*

**Appendix 7: Triple Irrigated Rice in the Mekong Delta**

| Year | Area (ha) | Cited source |
|---|---|---|
| 1975-1980 | Very few | Le Van Khoa (1997-1999) |
| 1985 | 1,108 | Tran An Phong (1986) |
| 1990 | 10,237 | Nguyen An Tiem (1993) |
| 2000 | >230,000 | GSO, 2000 |

*Source: Khoa L.V., 2001.*


**Appendix 8: Surface area of aquaculture and shrimp output in Vietnam and the MD from 1995 to 2004**

| | 1995 | 1996 | 1997 | 1988 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Surface area of aquaculture (Thousand ha)** | | | | | | | | | | |
| Vietnam | 453.6 | 498.7 | 504.1 | 524.5 | 524.6 | 641.9 | 755.2 | 797.7 | 867.6 | 904.9 |
| MD | 289.4 | 316.5 | 327.1 | 341.8 | 332.9 | 445.3 | 546.8 | 570.3 | 621.2 | 650 |
| MD/VN (%) | 63.8 | 63.5 | 64.9 | 65.2 | 63.5 | 69.4 | 72.4 | 71.5 | 71.6 | 71.8 |
| **Shrimp outputs (tons)** | | | | | | | | | | |
| Vietnam | 55,316 | 49,749 | 49,298 | 54,884 | 57,452 | 93,503 | 154,911 | 186,216 | 237,880 | 290,201 |
| MD | 47,121 | 39,652 | 38,133 | 39,382 | 41,400 | 68,995 | 118,432 | 142,909 | 182,221 | 230,662 |
| MD/VN (%) | 85.2 | 79.7 | 77.4 | 71.8 | 72.1 | 73.8 | 76.5 | 76.7 | 76.6 | 79.5 |
| Long An | 1.8 | 2.5 | 2.5 | 3.1 | 2.9 | 3.4 | 6.6 | 7.3 | 10.2 | 12.1 |
| Tien Giang | 9.6 | 9.2 | 9.1 | 9.1 | 9.8 | 8.4 | 8.8 | 9.6 | 10.8 | 11 |
| Ben Tre | 24.7 | 24.7 | 21.1 | 23.4 | 27.9 | 29.3 | 25.6 | 36 | 37.7 | 42.1 |
| Tra Vinh | 22.6 | 25 | 30 | 35 | 36 | 52.6 | 54.3 | 25.2 | 30.2 | 33.6 |
| Vinh Long | 1.2 | 1.1 | 1.1 | 1.2 | 1.2 | 1.4 | 1.3 | 1.4 | 1.5 | 1.6 |
| Đong Thap | 3.2 | 1.2 | 1.4 | 1.7 | 1.8 | 1.9 | 2.3 | 2.6 | 2.6 | 2.8 |
| An Giang | 1 | 1.3 | 0.9 | 0.9 | 1.2 | 1.3 | 1.3 | 1.8 | 1.6 | 1.9 |
| Kien Giang | 12.5 | 19.3 | 25.1 | 27.2 | 29.3 | 34.6 | 42.6 | 49.7 | 62.1 | 78.4 |
| Can Tho (*) | 8.3 | 10.5 | 11 | 12.5 | 11.9 | 12.6 | 13.6 | 16.5 | 10 | 11 |
| Hau Giang | | | | | | | | | 7.5 | 8.2 |
| Soc Trang | 3 | 24.1 | 28.5 | 25.8 | 30.5 | 41.4 | 53.2 | 48.3 | 57.1 | 51.4 |
| Bac Lieu | 41.4 | 42.6 | 42.2 | 40.3 | 38.9 | 54 | 83 | 100.6 | 112.3 | 118 |
| Ca Mau | 160.1 | 155.1 | 154 | 161.6 | 141.5 | 204.4 | 254.2 | 271.4 | 277.7 | 277.9 |

*Source: GSO, 2005*
*Notes: Cantho comprises Cantho city and Hau Giang province*

78

**Appendix 9: Fish raising output in Vietnam and the MD from 1995-2004**

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004* | % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vietnam** | 209,142 | 255,958 | 279,324 | 285,626 | 335,979 | 391,053 | 421,020 | 486,421 | 604,400 | 696,953 | |
| **MD** | 119,475 | 155,871 | 165,591 | 164,072 | 198,714 | 234,755 | 248,468 | 283,326 | 366,051 | 433,617 | |
| | | | | | | | | | | | |
| Long An | 3838 | 4,560 | 4,515 | 7,872 | 9,146 | 7,974 | 9,533 | 8,542 | 10,717 | 11,400 | 2.6 |
| TienGiang | 13,281 | 12,224 | 14,215 | 15,465 | 15,112 | 15,238 | 19,976 | 16,091 | 20,125 | 26,315 | 6.1 |
| Be Tre | 5200 | 4,725 | 7,490 | 5,215 | 5,675 | 7,331 | 9,313 | 7,244 | 9,848 | 9,575 | 2.2 |
| TraVinh | 8,523 | 7,394 | 14,500 | 15,400 | 15,100 | 17,863 | 19,091 | 25,353 | 31,312 | 31,815 | 7.3 |
| Vih Long | 6,093 | 6,110 | 6,092 | 6,144 | 6,503 | 6,907 | 8,159 | 11,470 | 17,112 | 22,120 | 5.1 |
| Đog Thap | 24,461 | 27,177 | 32,163 | 31,643 | 36,709 | 34,395 | 35,388 | 35,350 | 41,857 | 49,577 | 11.4 |
| An Giang | 34,421 | 47,993 | 41,133 | 40,728 | 60,742 | 80,032 | 83,335 | 110,157 | 136,231 | 150,238 | 34.6 |
| Kie Giang | 1,560 | 3,079 | 3,671 | 3,115 | 4,673 | 5,477 | 6,700 | 4,786 | 5,863 | 6,528 | 1.5 |
| Cần Thơ ** | 6,263 | 7,054 | 7,493 | 7,043 | 11,342 | 12,963 | 15,057 | 25,148 | 36,246 | 50,509 | 11.6 |
| Hậu Giang | | | | | | | | | 9,867 | 15,634 | 3.6 |
| Sóc Trăng | 2,676 | 6,814 | 3,386 | 2,121 | 2,520 | 3,173 | 3,800 | 7,620 | 9,414 | 13,696 | 3.2 |
| Bạc Liêu | 891 | 3,794 | 3,873 | 4,463 | 7,397 | 11,805 | 9,167 | 9,638 | 13,772 | 25,670 | 5.9 |
| Cà Mau | 12,268 | 24,947 | 27,060 | 24,863 | 23,795 | 31,597 | 28,949 | 21,927 | 23,688 | 20,540 | 4.7 |

*Source: GSO, 2005; *: Estimated,*
*Notes: Cantho comprises Cantho city and Hau Giang province*

**Appendix 10: The agro-chemicals usage in Can Tho Province from 2000 to 2003**

| Types of chemicals | Year | | | |
|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** |
| Fertilizers (Tons) | 169,329.0 | 175,926.5 | 182,457.6 | 187,946.0 |
| Agro-chemicals (Tons) | 654.8 | 635.3 | 657.6 | 1,013.0 |

*Source: The Department of Agriculture and Rural Development of Can Tho province, 2002-2003*

**Appendix 11: Active ingredients banned and restricted 1992-2000**

| Year | Number restricted | Number banned |
|---|---|---|
| 1992 | 14 | 20 |
| 1994 | 15 | 22 banned; additional five pesticides banned for rice crops: carbofuran, monocrotophos, methamidophos, endosulfan and phosphamidon |
| 1996 | 21 | 22 banned; three banned for import: methamidophos, monocrotophos and carbofuran |
| 1998 | 19 | 23 |
| 2000 | 27 | 26 |

*Source: Plant Protection Department, MARD*

**Appendix 12: Restricted pesticides imported, 1991-1998**

*Unit: Tons*

| Year | Total imports | Restricted pesticides | Percentage (%) |
|---|---|---|---|
| 1991 | 20,300 | 7,500-8,000 | 36.9-39.4 |
| 1992 | 23,100 | 7,500-8,000 | 32.5-34.6 |
| 1993 | 24,800 | 7,500-8,000 | 30.2-32.3 |
| 1994 | 20,380 | 3,000 | 14.7 |
| 1995 | 25,666 | 3,000 | 11.7 |
| 1996 | 32,752 | 3,000 | 9.2 |
| 1997 | 30,406 | 2,500 | 8.2 |
| 1998 | 30,000 | 1,500 | 5.0 |

*Source: Plant Protection Department, MARD*

**Appendix 13: A comprehensive nation-wide inspection in 2000 by Plant Protection Department**

| | | Value | % |
|---|---|---|---|
| 1 | Pesticide retailer operating without a business license (No of answers) | 388 | 23.4 |
| 2 | Retailers had no store for pesticides or the stores were failing to follow safety regulations (no fore and explosion extinguishers, no first-aid kids, and pesticides construction materials, food and animal feeds (No of answers) | 5,132 | 50.2 |
| 3 | Use banned pesticides (methamidophos, DDT and other chemicals) (kg) | 2,500 | |
| 4 | Illegally imported or counterfeit pesticides (litre or kg) | 4,753 litres | |
| | | 5,645 kg | |

*Source: Plant Protection Department, 2000 cited by Huan N. H., 2001*


**Appendix 14:The result of pesticide use of four provinces in the South of Vietnam (480 farmers)**

| | **Farmers' confidence, attitude and practices in safe and effective use of pesticides** | *%* |
|---|---|---|
| 1 | Farmers use pesticides excessively and not in compliance with the instructions on the labels | 96.6 |
| 2 | Know how to properly dispose of left-over pesticides | 4.8 |
| 3 | Farmers pour spray remains into canals, ditches or spray on other plants or use it up by continuing to spray | 95.0 |
| 4 | Bury pesticide containers and packing after use | 38.1 |
| 5 | Discard containers in the fields, into the canals, ditches, ponds or sell to scrap collectors or utilize for other purposes | Most answer |

*Source: Plant Protection Department, 2000 cited by Huan N. H., 2001*

# MARKET STRUCTURE AND MARKETING CHANNEL ANALYSIS:
# THE CASE OF PANGASIUS IN THE MEKONG DELTA

**Thai Van Dai**
**Luu Tien Thuan**
**Luu Thanh Duc Hai**

# 1. INTRODUCTION

## 1.1 Statement of problem

With the transition from a centrally controlled economy to a market economy, all sectors of the economy have been stimulated, especially in the fishery industry. The size of the fishery industry has increased in Vietnam. With strong supportive policies from the Ministry of Fisheries, farmers have adopted many different fishery varieties and have obtained higher yield. In addition, new technology in Vietnam has made a large contribution to improve productivity in fishery. As the market liberalization process continues, Vietnam faces the challenge of formulating and implementing an economic growth strategy. Vital in this growth strategy is the role of all sectors and, within them, the development of an efficient and flexible fishery marketing system as the present fishery marketing system in Vietnam is still very young.

In recent years, fishery in Vietnam has developed quickly. As a result the country has the potential to become one of the largest fishery export countries in the world. The national gross output of raised fish in 1990 was 129,330 tons, this increased to 604,401 tons by 2003. In the MD volumes in 1990, and 2003 were 66,836 tons and 366,052 tons respectively. The value of gross fishery output in the MD in recent years has significantly increased. According to the Statistical Yearbooks, in the MD gross fishery output was VND 19,721 billions, VND 22,660 billions, and VND 26,739 billions in 2001, 2002, and 2003 respectively. Fishery activities in general, particularly breeding fishery, have contributed significantly to the income of farmers in the MD.

In addition, the exported fishery has been increasing dramatically in recent years. Earnings from the fishery industry in Vietnam have increased from USD 285 million in 1991 to approximately USD 621 million in 1995 and again sharply to USD 2,021 million in 2002.

Currently, fishery products are Vietnam's third largest export commodity in terms of value (after crude oil and garment and textile), accounting for around 12% of total exports. Vietnam's fishery has been exported to around 64 countries, of which Japan, the US, the EU, China, South Korea and Taiwan are the biggest importers. Specially, export sales to the US market have been increasing rapidly in recent years from USD 34 million in 1996 to USD 617 million in 2002.

With the suitable natural conditions, breeding fish in the MD has been developing in recent years. Specifically, Tra and Basa fish are famous prodcuts of the MD. The farmers in the MD have big hopes on Tra and Basa fish. Business people and scientists are keen to turn Tra and Basa fish production into a major industry that can compete well in the world market.

Despite the trade policy of the US department of commerce, the feeding, processing and exporting of fish soared in the MD. In 2004, output and sales are likely to double the figures of 2003 to more than 300,000 tons at a value of USD 240 million. At present, Europe makes up 45% of Vietnam's Tra and Basa fish exports, the US 25% and other markets the rest.

However, Tra and Basa fishery industry still has weaknesses and difficulties in terms of distribution channels, production, processing and consumption systems in both domestic and foreign markets. Especially, the domestic market for Pangasius does not receive as much attention as the export market. Moreover, most farmers lack fish breeding techniques which has lead to high costs in the production process. The low quality of fish has also resulted in a low level of competitiveness in domestic and foreign markets.

From the issues mentioned above, there is apparent need to find out the current situation of fishery and how to get big sales in Tra and Basa fish consumption, and increase competitive ability in both domestic and foreign markets in the future. Therefore, the study on "Market structure and marketing channel analysis of Pangasius in the MD, Vietnam" is significant in giving good consideration for fishery industry in the MD.

## 1.2 Objectives of the study

The objective of this study is to describe the structure of Pangasius marketing channels from producers through to consumers; to find out the value-added of marketing channels in the MD and give some recommendations for further studies of Pangasius marketing channels in the MD.

## 1.3 Data collection

To conduct this study, both primary data and secondary data were used. The primary data were collected by interviewing actors in the supply chain of Pangasius consisting of breeders, traders, wholesalers and retailers in three provinces: Can Tho, An Giang and Dong Thap. These provinces are the main Pangasius production areas in the MD. The data was used to analyze the current situations, constraints and obstacles which affect the actors in the Pangasius marketing system. In addition, the data was used to estimate marketing costs and margins, and to demonstrate the behavior of actors.

## 1.4 Limitations and scope of the study

The data of production, marketing costs and processing were collected from three provinces including Can Tho, An Giang and Dong Thap provinces that are considered good representatives of fish breeding in the MD. However, the number of samples was limited such that the data was unable to demonstrate all SCP elements. In addition, due to time constraints, the study has concentrated solely on the analysis of Tra and Basa fish. In particular, the study focused on

the domestic Pangasius marketing channel including some, but not all, of the elements of the SCP model.

## 1.5  Outline of the study

The study is organized into 6 parts. The introductory section presents a statement of the study problem as well as the main objectives of the study, the study methodology, and the scope of the study. Part 2 outlines the current environment surrounding the fishery sector in Vietnam, including Pangasius production in the MD. Part 3 presents the structure of the Pangasius market in the MD in an attempt to describe the functions of actors who join the channel. Part 4 analyses Government policies and regulation that influence the Pangasius industry. Part 5 presents the value–created in the pangasius marketing channels. The final part gives the conclusions and some recommendations.

## 1.6  Study Methodology

One of the key objective of this study is to examine the domestic market structure of Pangasius in the MD and suggest further research to improved the effectiveness of Pangasius supply channels. The model of market structure, conduct and performance (SCP) is applied to study in agricultural marketing system in developing countries by many researchers including Jones (1972), Van Tilbrg (1988), Lutz and Van Tilburg (1992), Toolens (1992), Gooseens (1994) and Dijkstra (1997). The SCP analysis has been developed by Brain (1959, 1968), Clodius and Mueller (1961), Slater (1968) and Bateman (1976) (Luu Thanh Duc Hai (2003), *The organization of the Liberalized Rice Market in Vietnam)*. The SCP was also succesfully applied by one of the authors.

In this study, the SCP approach is integrated with the marketing channel approach and the division of value-created.. These approaches are used as a guideline to identify the different aspects of the problem.

According to the SCP model, there is a simultaneous relationship between market structure, conduct and performance. Market structure and market conduct influence market performance. In turn, market performance influences long run market structure and long run market conduct (See Figure 1 below). Clearly, performance in particular industries or markets depends upon the conduct of sellers and buyers, particularly in relation to pricing policies, product lines, investment in production facilities, and so on. Conduct depends in turn upon the structure of the relevant market, embracing such features as the number and size of distribution of sellers and buyers, the type of marketing channels, the degree of product differentiation, the presence or absence of barriers to entry, etc.
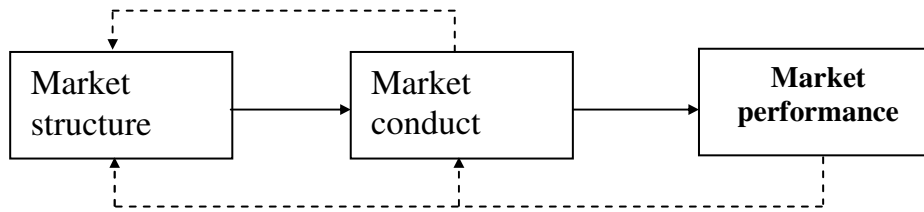
**Figure 1:    Dynamic model derived from the SCP approach**

Hai (2003) he applied the SCP model and integrated some concepts of the theory of institutional economic theory and the marketing channel approach. Table 1 presents the principal aspects that were used by Hai.

**Table 1:    Elements of Structure-Conduct-Performance**

| Elements of structure | Elements of conduct | Elements of performance |
|---|---|---|
| - Intermediaries involved in the marketing system<br>- Barriers to entry and exit<br>- Buyer and seller concentration<br>- The assortment of product quality<br>- Distribution of market information<br>- Structure of marketing channels<br>- Price formation process<br>- Rules and/or regulations that coordinate market exchange. | Conduct with respect to:<br>- Buying<br>- Selling<br>- Transport<br>- Storage<br>- Negotiation<br>- Processing<br>- Information<br>- Finance/risks bearing<br>- General trading strategies that traders conducted in order to follow market rules and increase marketing efficiency (reduce transaction costs) | - Effectiveness of supplied services; product suitability in relation to consumer preferences<br>- Efficiency of supplied services<br>+ Rate of profit in relation to marketing costs and price margins (arbitrage in time, space and form).<br>+ Transaction cost analysis (market searching; negotiating and concluding a contract; enforcing a contract)<br>+ Analysis of price differences and seasonal price fluctuation<br>+ Market integration<br>- Dynamic analysis of the market process |

*Source: Luu Thanh Duc Hai, 2003*

Knowing that there are thousands of producers and actors involved in the Pangasius market, we have confidently assumed that competition is high. Therefore, there is not much room for actors in the market to behave independently. They have to follow market rules as defined by its structural elements. In this paper, the elements of 'buyer and seller concentration' wiill not be considered as thousands of breeders and traders are small scale producers and traders. In addition, to analyze the elements of performance, this paper will not analyze and evaluate the efficiency of marketing channel, the market

integration, the transaction cost as well as analysis of price differences and seasonal price fluctuation because of limited data.

In Hai's model, one of the components analysed is the 'margin'. In this paper, this method is also applied and the results are used to analyse the distribution of value created amoungst actors in the supply channel. For the present study, the elements in Table 1 have been modified into those in Table 2 for use in this paper.

**Table 2:    Modified Elements of Structure-Conduct-Performance**

| Elements of structure | Elements of performance |
|---|---|
| - Intermediaries involved in the marketing system<br>- The existence of entry and exit barriers<br>- The assortment of product quality<br>- The distribution of market information<br>- Characteristics of marketing channels<br>- Price formation process<br>- Rules and/or regulations that coordinate market exchange. | - Value-added and value created analysis to identify where the economic value is created within a value chain. |

With respect to market structure, first of all we pay attention to the actors/intermediaries involved in the market. This information defines the general picture of the channel systems. Secondly, we focus on competitiveness by using three major criteria such as barriers to entry and exit, the assortment of product quality and distribution of market information.

The existence of entry and exit barriers influences the competitive relationship between firms and potential entrants. If barriers to entry and exit are minimal, new firms can easily enter into and exit from the Pangasius market and compete with established firms. However, with the presence of very high barriers to entry and exit, new established firms are well protected from potential rivals (*Philip Kotler, Marketing Management, 8$^{th)}$*). There are three main types of structural entry barriers: (1) Control of essential resources: an incumbent firm is protected from entry if it controls a resource necessary for production. (2) Economies of scale and scope. When economies of scale are significant, established firms operating at or beyond the minimum efficient scale will have a substantial cost advantage over smaller entrants. Economies of scope in production stems from flexibility in material handling and scheduling, that arises from having multiple production lines within the same plant. Economies of scope in marketing are due to the substantial up-front expenditure on advertising that is needed for a new entrant to establish a minimum acceptable level of brand awareness. Economies of scale and scope create barriers to entry

because they force potential entrants to enter either on a large scale or with large product diversity, in order to achieve unit cost parity with the incumbent firms. (3) marketing advantages of incumbency. Exit barriers arise when firms must meet obligations independent of whether they produce or not (*D.Besanko, D.Dranove, M. Shanley and S.Schaefer, PP 301-310, Economics of strategy, International Edition)*. In the case of pangasius, the entry and exit barriers will be measured by (1) Government policy; (2) control of essential resources (raising techniques, land); (2) marketing advantages of incumbency (fluctuation of market price, low demand**,** market information); and (3) economies of scale and scope (capital requirement).

The assortment of product quality examines the extent to which buyers differentiate, distinguish or express their specific preferences among competing products of the various sellers. Factors such as product quality and product type are common attributes of product differentiation. In the case of Pangasius, product differentiation both at a farmer and trade level are examined in terms of different varieties of Pangasius (Basa or Tra), degree of weight and color of the meat (white or yellow).

The distribution of market information refers to the availability of relevant market information. This could be obtained by assessing the producers' awareness of the market price and the manner by which price information is disseminated amongst producers. The distribution of market information shows how market information is disseminated to producers and traders, what/who are the sources of market information and the adequacy of this information in terms of risk reduction.

Another element of structure is characteristics of marketing channels. Marketing channels are defined as the flow of products from the place of production to the place of ultimate consumption. The structure of marketing channels helps to determine relationships between different actors in the markets.

The process of price formation is determined by the following elements: market power, bargaining skills and transaction specific characteristics such as product quality, volume of sales per transaction, and sales location. In general, a processor who is considered as a market leader usually has high market power (in relation to price setting). Product Quality is related to consumers' preferences as well as the colour of the meat. Volume of sales measures the level of sales of traders and retailers. Finally, sales location also directly effects price, as transport costs may be significant.

In order to examine market structure from an institutional viewpoint, we must also describe the major policies and regulations of government in Pangasius industry.

A few further remarks are necessary regarding the analysis of market performance.

'Value-created' is the difference between the benefit B and the unit cost C of the product. Value–added analysis is a tool for understanding where economic

value is created within a firm's value chain. The value–added analysis proceeds as follows:

- Value-added in manufacturing is the profit that would have been made if the all products of producer are sold to next actor in the channel

- Value-added in distribution is the incremental profit made by self-distributing products to retailers or to wholesalers (*D.Besanko, D.Dranove, M. Shanley and S.Schaefer, PP 418-419, Economics of strategy, International Edition*)
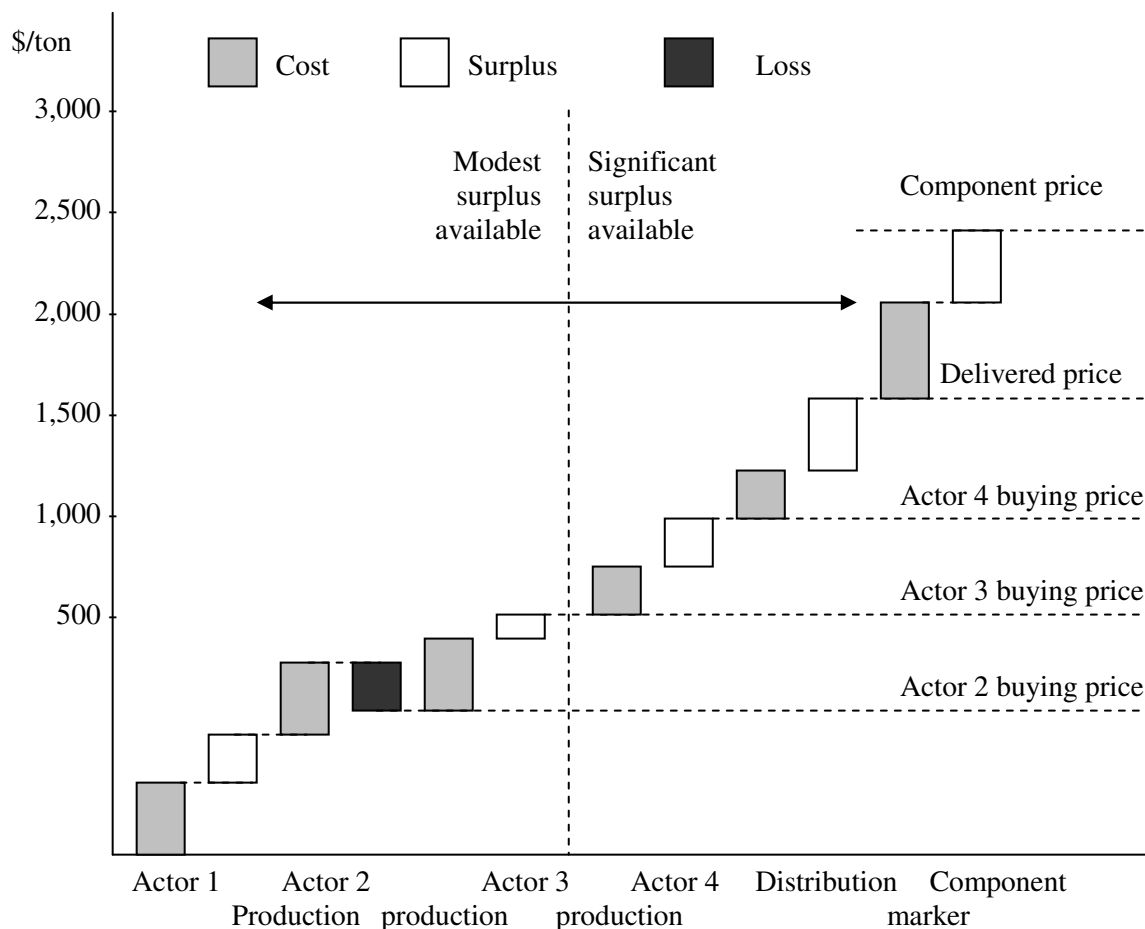
**Figure 1:    Division of value – created in the production of one industry**

Figure 1 illustrates the division of value-created in an industry. Actor 1, 2 and 3 capture only modest portions of the overall value-created. They are characterized by strong price competition and low profitability. Distributors and actor 4, by contrast, capture a relatively larger proportion of value-created and earn high profit.

Division of value-created are applied in the case of Pangasius. Each actor in the pangasius marketing channel will be analyzed based on production costs, incremental cost and marginal profit in order to define the distribution of profit among actors. Two ratios are used for analysis: the profit margin - total cost ratio and the profit - extra cost ratio.

$$\text{Profit margin\_total cost ratio} = \frac{\text{Profit margin}}{\text{Total cost}} \quad (1)$$

$$\text{Profit\_Extra cost ratio} = \frac{\text{Profit}}{\text{Extra cost}} \quad (2)$$

These ratios will show the relationship between the profit margin and total cost (or extra cost) that each actor earns. A comparison between these ratios for each actor in distribution channel will be made to determine which actors have higher percentages of profits and to find out reasons why the profits for each actor is distributed differently. This is hoped to stimulate further research in the future.

To do the above things, primary data is collected to estimate the production costs of producers; marketing costs and marketing margins of various traders. From these results, total cost and total-marketing costs of various marketing channels can be calculated. Direct marketing costs include transportation costs, electricity and water costs, rent, selling-buying ground. Processing will also be taken into account. Thus the percent share of each cost item for each type of trader is computed.

Secondly, 'profit margin' measures the rate of return on gross sales after all costs involved in rendering marketing services are deducted. The profit margin will be calculated as follows:

$$\begin{array}{ccc} \text{Profit margin} & \text{Total marketing margin} & \text{Variable marketing cost} \\ = & & - \\ \text{of each type of trader} & \text{of each type of trader} & \text{of each type of trader} \end{array}$$

The survey was conducted on 40 fish breeders and 15 assemblers/traders. Samples of fish breeders, which comprised 20, 10 and 10 breeders in An Giang, Dong Thap, and Can Tho respectively, were collected.

The secondary data, namely time series data from the Statistical Yearbooks, Annual Summary Reports, and previous researches were, used to describe the

situation of fishery and Pangasius production and distribution in Vietnam and in the MD as well. Further data and information about Pangasius were obtained using additional methods. For example, the numbers of cages, companies, fish breeding area, etc. were collected from websites.

## 2. OVERVIEW OF VIETNAMESE FISHERY INDUSTRY AND PANGASIUS PRODUCTION IN THE MD

### 2.1    GENERAL CHARACTERISTICS OF VIETNAMESE FISHERY

Vietnam is situated in the South East Asian region, with a 3,260 km coastline stretching from MongCai to Ca Mau. There are 226,000km of inland and territorial water area in Vietnam. The sea area of Vietnam is divided into four areas, namely the North Sea, the Central Sea, the South-East Sea and South-West Sea areas. There are more than 2,000 fish species in Vietnam, of which approximately 130 species have a high economic value. The marine fish stock in the sea area is estimated at 4.2 million tons, of which the annual allowable catch is 1.7 million tons.

Vietnamese seafood is a common import to the EU and US markets and the market share expanded rapidly since 1998 onwards. On June 12, 1998 the Vietnam Association of Seafood Exporters and Producers (VASEP) was established, gathering of most all fishery companies. In 1999, export turnover reached approximately US$938 million (Japan 41%, US 14%, EU 10%, China and Hong Kong 12.5%). By 2000, Vietnam had built 70 fishing ports, including 54 coastal ports and 16 ports located on islands off the coast of the country. The infrastructure of fishing ports consists of services such as providing fuel, vessel services and storing fish, etc. The fishery industry had a high growth rate of on average 20% per year. This gave it a third position among export revenues earners in Vietnam, accounting for 12.24% of total exports of Vietnam in 2002. Vietnam had become the world's nineteenth nation in terms of export volume and twenty-ninth in terms of export value[3]. In 2003, the value of Vietnamese fishery was approximately 24,125 billion VND, accounting for 3.93% of total GDP.

Vietnam has many freshwater resources – such as rivers, lakes and ponds – which hold great potential for the freshwater fish industry. Generally, natural

---

[3] *Huy HT, 2003, Export promotion of fishery products the case of tra and basa fish products in the Mekong Delta, Vietnam.*

conditions in the MD are suitable for raising freshwater fish and marine species, which contribute to increased income and living conditions for people in rural areas. Consequently, the fishery industry plays an important role in the development in Vietnam's economy. Especially, in the MD along with rice, fresh water fisheries are key in developing the regional economies and play an essential role in the rapid increase the export markets for Vietnamese fish products, especially Pangasius.

**Table 3: Fish culture area by province in the MD (Unit: ha)**

| Province | 2001 | | 2002 | | 2003 | |
|---|---|---|---|---|---|---|
| | Total | Of which: Fresh water fish | Total | Of which: Fresh water fish | Total | Of which: Fresh water fish |
| **MD** | **104,575.6** | **90,888.6** | **88,421.8** | **82,029.7** | **92,531.0** | **84,332.0** |
| Long An | 1,508.0 | 1,508.0 | 1,466.2 | 1,466.0 | 2,048.0 | 1,985.0 |
| Dong Thap | 1,678.0 | 1,678.0 | 2,035.4 | 2,035.4 | 2,226.0 | 2,226.0 |
| An Giang | 984.0 | 984.0 | 1,465.0 | 1,465.0 | 1,123.0 | 1,123.0 |
| Tien Giang | 4,247.6 | 4,114.6 | 4,885.3 | 4,779.2 | 5,257.0 | 5,194.0 |
| Vinh Long | 1,254.6 | 1,254.6 | 1,342.9 | 1,342.9 | 1,487.0 | 1,487.0 |
| Ben Tre | 2,873.0 | 1,731.0 | 3,670.0 | 1,952.0 | 3,722.0 | 2,506.0 |
| Kien Giang | 15,000.0 | 15,000.0 | 10,993.0 | 10,993.0 | 10,284.0 | 10,284.0 |
| Can Tho | 13,089.0 | 13,089.0 | 15,995.0 | 15,995.0 | 10,284.0 | 10,284.0 |
| Tra Vinh | 22,167.0 | 10.483.0 | 8,139.0 | 4,649.0 | 16,913.0 | 16,913.0 |
| Soc Trang | 3,820.0 | 3,170.0 | 5,272.0 | 4,694.0 | 6,166.0 | 5,846.0 |
| Bac Lieu | 1,577.4 | 1,577.4 | 1,929.0 | 1,429.0 | 2,200.0 | 150.0 |
| Ca Mau | 36,377.0 | 36,299.0 | 31,229.0 | 31,229.0 | 29,660.0 | 28,763.0 |

*Source: www.fistenet.gov.vn*

Figures from table 3 indicate that the fish culture area has been reduced. Particularly in KienGiang, TraVinh, SocTrang, BacLieu and Ca Mau provinces which have faced a considerable reduction in fish production as the areas are more suited to shrimp production. However, other provinces such as An Giang, Can Tho, Dong Thap can increase the area of fish breeding, especially Pangasius, because of their of suitable natural conditions.

## 2.2 GENERAL INFORMATION ABOUT PANGASIUS AND DEVELOPMENT PROCESS OF PANGASIUS INDUSTRY

In this study, Basa and Tra fish are referred to as Pangasius. The Pangasius farming has been a traditional means of livelihood for many farming households

who have settled along the Mekong River. More than 400,000 underprivileged farmers have subsisted on Pangasius farms, particularly in the provinces of An Giang, Dong Thap and Can Tho. Pangasius farming is not only an important food supply source for residents in the region, but also an important source of income for many rural families who are farmers, labors involved in production, traders, or feed suppliers etc. Pangasius is a type of catfish which has a high economic value both for exports and in the domestic market.

Before 1986, farmers raised Pangasius mainly for the domestic market. In 1986, through the support of Australian experts and the establishment of the Agifish Company in An Giang, Pangasius were produced and exported to Australia as fillet products. Until 1990, Pangasius fillets were exported to Asia, Hong Kong, Japan and China etc. Intermediary markets were also established to push Pangasius fillets into Northern European and EU markets. At the same time, Pangasius farming expanded to other provinces of the MD, this was due to increased demand for raw fish material. Most farming households who were involved in Pangasius farming were changing from traditional culture into intensive culture.

Thanks to the Government's trade liberalization reforms, Pangasius farms have been able to grow substantially every year in order to meet international market demand. Since 1996, increased demand from the US has led to the creation of a new market for which Vietnam contributes approximately 2% of the Pangasius supply.

Fishery development has created the opportunity for farmers in the MD to diversify their production activities and improve their living standards. In 2002, fishponds were regularly increasing in size in Vietnam. Disadvantaged farming households generally rear fingerlings in ponds while richer households use cages along the Mekong River. This is because the cost to purchase a cage is relatively high, usually more than VND 200 million.

The number and volume of cages for fish and Pangasius in the MD has increased. Specifically, Dong Thap, An Giang and Can Tho provinces have expanded the volume of Pangasius culture. An Giang has the largest volume at 578,822 $m^3$. Seconly is Dong Thap which has a volume of 105,446 $m^3$.

**Table 4:    Number and volume of cages by provinces in the MD**

| Province | 2001 | | 2002 | | 2003 | |
|---|---|---|---|---|---|---|
| | Quantity (cage) | Volume (m$^3$) | Quantity (cage) | Volume (m$^3$) | Quantity (cage) | Volume (m$^3$) |
| **MD** | **7,015** | **182,048** | **8,357** | **720,151** | **7,267** | **744,118** |
| LongAn | 1,556 | 10,242 | 1,340 | 12,016 | 757 | 10,626 |
| Dong Thap | 1,917 | 35,930 | 2,388 | 113,927 | 2,420 | 105,446 |
| An Giang | 3,237 | 127,825 | 4,053 | 573,323 | 3,178 | 578,882 |
| Tien Giang | 39 | 624 | 20 | 1,176 | 56 | 5,115 |
| VinhLong | 0 | 0 | 108 | 4,080 | 165 | 7,396 |
| BenTre | 0 | 0 | 0 | 0 | 8 | 158 |
| KienGiang | 0 | 0 | 70 | 1,810 | 70 | 1,992 |
| Can Tho | 262 | 7,232 | 307 | 10,523 | 366 | 19,695 |
| TraVinh | 0 | 0 | 18 | 648 | 219 | 13,304 |
| SocTrang | 4 | 195 | 53 | 2,648 | 28 | 1,504 |
| BacLieu | 0 | 0 | 0 | 0 | 0 | 0 |
| CaMau | 0 | 0 | 0 | 0 | 0 | 0 |

*Source: www.fistenet.gov.vn*

## 2.3    SITUATION OF PANGASIUS PRODUCTION AND PROCESSING IN MEKONG DELTA

In 2002, there were 19 Pangasius processing and exporting companies and more than 4 million people involved in fishery activities. Pangasius makes up a significant portion of fisheries production and consequently is a necessary source for the development of the fisheries industry. Unfortunately in the same period the fisheries labor force was unable to meet the demand for fishery development due to factors such as low education levels, lack of professional knowledge and finance. The process of raising Pangasius was limited as well as inefficient[4].

Since 1997, Vietnamese enterprises have exported directly to foreign markets. In 1998, exported volumes of Pangasius fillet products were approximately 6,000 tons and by 2002 it was around 27,987 tons. Export volumes rose more than 32,875 tons in the year 2003. The value of the gross output of fishery in the MD also increased significantly according to Statistical yearbooks, these values were VND 19,721 billion, 22,660 billion, and 26,739 billion in 2001, 2002 and 2003 respectively.

---

[4] *Huy HT, 2003, Export promotion of fishery products the case of tra and basa fish products in the Mekong Delta, Vietnam*

From 1997 to 2002, Pangasius fillet processing for export developed rapidly, particularly in provinces such as Can Tho, An Giang, Dong Thap, Vinh Long and Tien Giang. Processing capacity increased from approximately 17,895 tons in 1997 to 86,600 tons in 2002.

Currently, Vietnam exports Pangasius to many countries including the U.S., the EU, Japan, Hong Kong and Singapore. In addition, because the MD has suitable natural conditions for raising Pangasius and highly experienced fishermen, Pangasius farms have developed rapidly every year since 1996. Fishermen usually apply advanced production methods in order to improve productivity and subsequently income.

After the US lifted its embargo on Vietnam in 1994, exports of frozen Basa fillets has increased continuously, helping hundreds of thousands of fishermen to overcome poverty. However, this dynamic development was interrupted when the US government imposed penal duties for the dumping of catfish in June 2003. The US International Trade Commission – upon the instigation of American catfish farmers who alleged that subsidies in Vietnam were distorting competition – imposed penal duties on Basa fillets. Within just a few months, Vietnam's exports of Basa to the US fell by approximately 50%. Despite the fact that Vietnamese producers had managed to sell a portion of their surplus on other markets, the resulting problems in Vietnam were still immense (a cost of approximately 32,875 tons and 81 million USD - see table 5).

**Table 5:    Pangasius products export to foreign markets**

| Market | 2001 | | 2002 | | 2003 | |
|---|---|---|---|---|---|---|
| | Quantity (Ton) | Value (US$1,000) | Quantity (Ton) | Value (US$1,000) | Quantity (Ton) | Value (US$1,000) |
| **Total** | **1,739.5** | **5,058.3** | **27,987.3** | **86,979.2** | **32,875.9** | **81,070.6** |
| Japan | 9.3 | 41.3 | 631.9 | 1,895.6 | 505 | 1,412.1 |
| EU | 50.0 | 161.0 | 2,264.8 | 7,278.1 | 5,922.2 | 15.525.9 |
| U.S | 1,279.6 | 3,911.6 | 17,250.0 | 54,828.2 | 8,803.0 | 23,956.1 |
| Asia, others | 400.6 | 944.4 | 7,840.6 | 22,977.3 | 17,645.7 | 40,176.5 |

*Source: www.fistenet.gov.vn*

The production of farms raising Pangasius is still one of the fastest growing industries in the MD. Over half of the production of Pangasius was exported to the US, Europe, China, Russia and Japan while consumption of fish products within Vietnam has also been on the rise. Pangasius production is now ranked second in the region after rice in terms of value . The turnover from Pangasius

exports in 2004 stood at 125 million USD, more than 1.5 times what it was in 2003[5]. Therefore, increasing productivity has become an urgent issue for the fishery industry in the MD. In year 2004, hundreds of thousands of people were engaged in the fisheries sector, including the raising of Pangasius which has also been expanding. This development has called for increased automation and processing proficiency in order to meet demand from both processors and customers globally. In the MD there are 27 fisheries export processing companies for which processing productivities are 1,100 tons of fresh fish per day. Volumes of Pangasius fillet exported by these export processing companies increased from 5,000 tons in 1996 to 40,000 tons (including other kinds of fish) in 2004.

In August 2005, three US states banned Pangasius importation from Vietnam because of unsatisfactory quality and what was considered a dumping price. This lead to a considerable change in export market structure. According to VFA, the current export structure includes: 60% of exports to the EU market, 30% to Asian markets, Mexico and Australia and only 10% to the US market compared to nearly 40% in previous years. In general, Vietnam's export markets grew in the first 6 months of 2005 and have continued to grow since (excluding the EU market - see table 6).

---

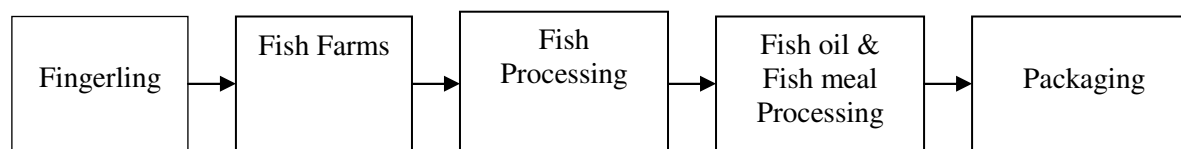[5] *Reorganize aquaculture production in the MD 21/9/2005*

**Table 6:     Vietnam's export markets (Jan-June 2005)**

| Market | Revenue (US$ billion) | Year on year growth (%) |
|--------|------------------------|--------------------------|
| Asia | 7.30 | 21.3 |
| ASEAN | 2.35 | 40.0 |
| Europe | 2.77 | -2.0 |
| Americas | 3.08 | 24.9 |
| The U.S. | 2.50 | 15.0 |
| Oceania | 1.20 | 55.6 |
| Africa | 0.29 | 18.0 |

*Source: Ministry of Trade*

# 3.   STRUCTURE OF THE PANGASIUS MARKET

## 3.1   ROUND CIRCLE OF PANGASIUS PRODUCTION

Fingerling → Fish Farms → Fish Processing → Fish oil & Fish meal Processing → Packaging

*Source: Nam Viet Company., Ltd.*

**Figure 2:    Round circle of Pangasius production**

According to figure 2, fish farms usually buy fingerlings (3-4cm) from fish feed producers in the same district. In the case of Dong Thap and ChauPhu (An Giang) provinces, the average quantity bought by fish farms is approximately 50,000 fingerlings per time. Feed producers will deliver fingerlings to the fish farm gate and guarantee the quality of fingerlings for 7 days. In some cases, feed producers will visit the fish farms in Chau Phu or Dong Thap provinces and introduce fingerlings to them.

Fish farms will generally raise the fingerlings until their weight is greater than 700 grams, sufficient for the white and light yellow meats of Pangasius. At that point, fish breeders will sell harvested Pangasius to processing companies such as Nam Viet Company Ltd., Tuan Anh Company Ltd., Agifish, Afiex and Cafatex etc (these processing companies are located in Can Tho, An Giang and Dong Thap provinces). The processing companies then process the fish under quality control standards such as HACCP, EU Code DL152 & ISO 9001: 2000.

Nam Viet Company Ltd. (NAVICO) is the biggest Pangasius processor and exporter in Vietnam and also South East Asia. It has 3 aquatic product processing factories, namely Nam Viet Fish Freezing factory, Pacific Seafood Freezing factory, and Atlantic Seafood Freezing factory. NAVICO hires 12,000 processing engineers and skilled workers and uses 720 million tons of raw material to produce 75,000 million tons of fish fillets and other processed

aquatic products; 30,000 million tons of fish oil; 9,000 million tons of fish skin; and 30,000 million tons of fish meal and fish powder annually. The total cold-storage capacity of NAVICO is 13,000 million tons.

The fresh fish products (value added products) of Pangasius processing companies include the following products:

- Pangasius Fillet
- Pangasius Steaks
- Pangasius Balls
- Pangasius Head
- Pangasius Portions
- Skinless Pangasius Steaks
- Skin-On Pangasius Fillet
- Untrimmed Pangasius Fillet
- Whole Dressed H&G Pangasius
- Pangasius Stomachs
- Pangasius Skewers
- Pangasius Strips
- Whole Cleaned Gutted Pangasius
- Pangasius Steaks

These fresh fish products are packaged using cartons or plastic bags and labeled. In general, Vietnamese Pangasius are of better quality, hygiene and nutrition and sell at a more competitive price than Pangasius bred in other countries, particularly American fish.

## 3.2 INTERMEDIARIES INVOLVED IN THE PANGASIUS MARKETING SYSTEM

### 3.2.1 The Trader

Traders collect and buy Pangasius throughout the year. In the peak months, February, March and April, the percentage of Pangasius purchased by traders is at its highest point, as shown in figure 3. There are two reasons to explain the peak purchasing months. First, fish breeders are concerned about the pollution of river water from the rice fields during the flood season – August, September and October. This pollution causes epidemic diseases that affect Pangasius. Second is the weather, fish farmers want to sell their products before winter due to the increased risk of epidemic disease.
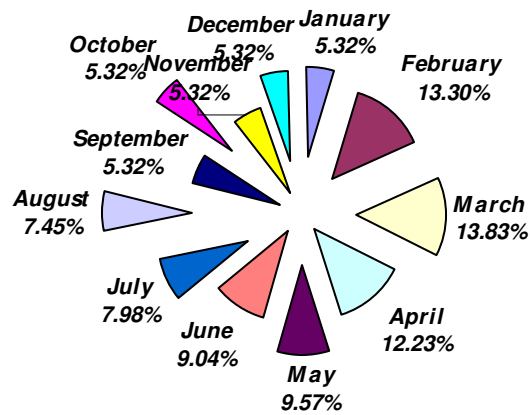
*Source: Market analysis of cultured Pangasius in the MD, Vietnam, Son NP, 2003*

**Figure 3:    Trader Procurement Percentages**

In some provinces such as An Giang, Dong Thap, Can Tho and Tien Giang, there are hundreds of traders who collect and supply fresh Pangasius to local markets in the MD. The Pangasius accounts for 20% of total fish quantity. During harvest season, traders will travel to any location in order to purchase Pangasius, including places quite a distance from the market place. At these places traders can purchase Pangasius at a price lower than the market price, however transportation costs increase. Traders negotiate with fish breeders as well as gain samples of Pangasius in order to quality test the fish using experienced judgement or modern testing machines. The price negotiation process is based on factors such as fish quality and time to delivery. After reaching an agreement, traders bring the purchasing representatives of the processing companies to purchase the Pangasius. Traders rent motorcycles to carry the Pangasius from the farm gate to concentration points where the stock is transferred to the processing companies by trucks (2-5 tons). In cases where there is a large volume of Pangasius, traders use boats to carry the Pangasius from the farm gates to the processing companies who purchase and process the fish and then export the processed products to the market.

If the fish quality requirements of processing company are not met, for example, if the fish weight less than 1 kg or have a non-white color meat etc. the Pangasius will be sold onto domestic markets such as those in HoChiMinh city and provinces in the MD. The price of these fish is usually only 60-70% of the price of exported fish. If traders do not depend on processing companies in the business process, it becomes very difficult to sell their product in the case of abundant fish supply.

Traders face risk when selling their product on consumer markets. In some cases, traders accept low prices from wholesalers at local markets despite the fact that their fishes satisfy export requirements.

After purchasing the Pangasius from fish breeders, traders sell the product immediately to wholesalers and processors. Traders do not store Pangasius, even for just a few days, because of associated risks such as increased cost (ten million dong per day), capital use and market price fluctuations (especially in unstable foreign markets like the US and EU markets). Therefore, traders will identify the Pangasius that meets the quality requirements of processors and then deliver them (within the same day) to processors using their own boats or processors' trucks. In some cases, traders will even take employees from the purchasing division of the processing company to check and test for Malachite Green before processors decide to sign the purchase agreement. Traders purchase Pangasius based on quality, color, size and weight. Almost all traders sign advance contact agreements with processors to confirm purchasing price, volume and time to delivery.

### 3.2.2 Processing company

According to surveys, most processing companies have their own Pangasius purchasing staff who purchase Pangasius from fish breeders based on the processing plan. On occasion, processing staff will visit fish breeders and purchase Pangasius through the raising schedule of fish breeders. The processing companies may also give cash in advance to fish breeders so that they are able to invest in raising fingerlings that they will sell to the processing company at harvest. They may also give cash in advance to fish breeders at other stages – including the approach of harvest – such that fish breeders are able to improve feeding and raising techniques to ensure that the quality of the Pangasius is high. In short, fish breeders sell fish to purchasers under a contract between the fish breeders and processing companies.

Nowadays, processing companies use modern technology and equipment. Efficient weighing and grading have been some of the primary requirements for many Pangasius processors. Processors who grade fillets before they are frozen either in bulk or IQF have received the Compact Grader very well. The capacity of the grader is up to 120 pieces/min, and the accuracy is 2g for pieces fewer than 500g, or 5g otherwise. The machine is configured as a six-gate grader and is user friendly with minimal installation requirements. The equipment can be installed, in most cases, by the customer, and be operational in just a few hours. This has proven to be very beneficial in this market, as simplicity and ease of operation are very important to Vietnamese processors.

### 3.2.3 Fish breeders/fishermen

Fish breeders are farmers who breed Pangasius in their own ponds or floating cages on a river. Pangasius breeding has been a traditional role for fish breeders living in the MD. According to the survey, fish breeders are generally professionally experienced, with the average number of year's experience of

Pangasius breeders being between 8 to 20 years. Due to a large amount of experience in fish breeding, farmers have knowledge about production techniques; the protection environment and natural fishery resources; food safety and security; and market information in order to capture the demand of domestic and foreign consumer markets.

Pangasius are freshwater fish that are found widely throughout An Giang, Can Tho and Dong Thap provinces. They are raised in natural ponds and floating cages on rivers. Farmers usually yield two crops a year. During the 2000s, due to the development of export markets, the quantity of Pangasius has grown rapidly. Many farmers have decided to dig ponds for raising Pangasius instead of growing rice or fruit crops, which are less efficient and consequently generate lower profit. It takes approximately 8-10 months to raise Pangasius in the ponds and 6-7 months in floating cages along rivers, this is due to the difference in water flow conditions. When raising Pangasius in cages, fish farmers will fix their own cages on a river where the flow of water is high and consistent with fish biology. The average area of a floating cage is 280 m$^3$, in which the average length, width and depth are 12m, 6m and 4m, respectively. In contrast, breeding Pangasius in ponds is only popular for the breeding of Tra fish because of the specific biological characteristics of the fish. Normally, the average content of a pond is 10,000m$^3$, in which the length and width of the pond is much longer and wider than that of the cage (length is 70m and width is 45m). The difference between floating cage and pond depths is approximately one meter, in which the depth of cage is deeper than the pond. In addition, it is more costly to build a floating cage as compared to building a pond, as cages require a large quantity of wood.

Cages are only allowed to be built in limited areas as the river also supports the transportation of boats and ship. Breeders must also get permission and satisfy the requirements of the local authority. For example, cages must not get in the way of river traffic and must not obstruct water flow, particularly during the flood seasons in the MD. In the case of pond farming, fish farmers will dig their own land, thus the area of the pond depends on the availability of land area and finance. Most ponds are dug near rivers in order to facilitate the changing of water through pumping water from rivers to ponds and vice versa such that Pangasius are able to grow quickly.

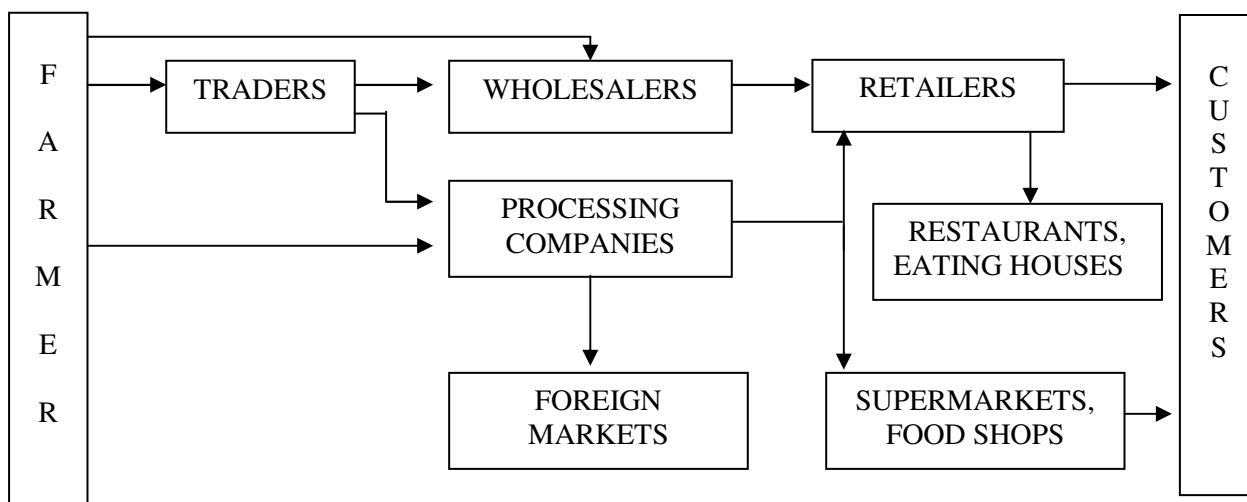## 3.2.4 Pangasius marketing channel in the Mekong Delta



**Figure 4:    Pangasius marketing channels in the MD**

After harvesting, farmers (fish breeders) sell Pangasius to processing companies who process the fish into value added products such as those mentioned in the first section of Part 3. Processing companies then export their products to foreign markets such as US, Europe, China, etc. as well as selling them on domestic markets through supermarkets, food shops and retail systems (figure 4). The processing companies also buy raw materials from traders who buy Pangasius from the fish farms. Therefore, both fish farms and traders sell Pangasius directly to the processing companies. In some cases, employees of the processing companies will visit the fish farmers and sign agreements based on quality and quantity of the Pangasius to be purchased. Although, contract agreements between fish farms and processing companies is yet to become popular in the MD, as fish farmers dislike being bound to a selling price by companies. Fish farmers prefer to have the freedom to select buyers who offer the most reasonable price at harvesting time. However, contracts between traders and processing companies are more popular as traders can guarantee stable input materials to processing companies due to their prestige. Besides that, traders also sell fresh Pangasius to wholesalers who resell the fish to retailers and consumers.

According to the survey, payment by cash is a popular transaction method between fish breeders, traders and processing companies. Nevertheless, 25% of traders and 13% of processing companies responded that they still make payment without cash such that that the payment is received after the product is purchased. The credit term for payment is approximately two weeks for traders and one week for processing companies. Traders need longer-term payment

periods as compared with processing companies as traders have limited capital and must pay the farmers in cash from the money received from processing companies, which may be either cash or credit.

## 3.3 COMPETITION IN FISH MARKET OF THE MEKONG DELTA

### 3.3.1 The existence of entry and exit barriers

**The processing company**
In 2005, there were 27 processing companies in the MD, some of which concentrated on processing Pangasius and producing exportable products such as An Giang Fishery Import Export Co. (Agifishco), AFIEX, Nam Viet Co. Ltd. (NAVICO), Tuan Anh Company Ltd. (NTACO), AFASCO, Can Tho Animal Fishery Products Processing Export Enterprise (CAFATEX), and Kim Anh Company Ltd. These companies concentrate on raising fish in floating cages as well as producing fish paste, frozen fish, cut squids, and seafood mix, etc. Generally, these companies hire at least 1,000 employees, of which female employees accounting for approximately 75% of total staff on average. AGIFISH, which hires 2,300 employees, has 72% female workers. The average capacity of a firm can reach around 40 tons of fresh fish per day (which can produce 12 tons of product). Companies exported 90-95% of products, whilst only 5-10% was delivered to local market through agencies, supermarkets and food shops.

**Government policies**
The main barrier to entrance to the export market for processing companies in An Giang, Dong Thap and Can Tho provinces is government regulation that prevents the building of additional Pangasius processing companies. Therefore, existing processing companies need to invest and upgrade modern processing systems in order to meet the technical requirements of foreign markets such as US, EU and Japan markets. They are also required to invest in fish farms in order to help control the quality of Pangasius. For example, Agifish has recently invested over VND 30 billion into a processing factory for frozen aquatic products.

**Control of essential resources (raising techniques, land)**
Barriers to raising fish, such as the need to own their own farms, face new entrants to the market. Consequently, the raw material is dependant on fish breeders. Currently, processing companies face difficulties in supplying large quantities of high quality because most fishermen do not follow strict feeding techniques, often over-using chemical treatments for Pangasius. Furthermore, in South Vietnam, there are only two quality testing centers, which are located in HoChiMinh city. If the processing companies want to test the quality of the

Pangasius, they must send samples to quality testing centers in HoChiMinh city which takes at least one week until test results are received. During that one-week, other companies may buy the Pangasius after using only simple testing methods. Thus, if processing companies do not use the quality testing centers they risk purchasing a lower quality fish but at least they will not give other companies the opportunity to purchase.

## Marketing advantages of incumbency (fluctuation of market price, low demand, market information)

High competition in local and world markets has led to the marketing advantages of incumbent firms creating a barrier to entry for new comers. Many processing companies face difficulties in their businesses because of market price fluctuation and the degree of competition in international markets. Almost all processing companies export 90-95% of their product to foreign markets such as the US and EU. Therefore, their business activities depend strongly on fluctuations in international price. This is due to technical and trade barriers such as anti-dumping prices, import tariffs, antibiotic residue etc in the import market. Firms face a higher risk by choosing a single market strategy rather than a multi-market strategy. In 2004, the US market imposed high import tariffs, ranging from 36-63%, on Vietnam's Pangasius. As a result, it was hard for processing companies to compete in the US market. In addition, Cambodia and Thailand have begun to export catfish to the world market. These issues affect the level of entrance barriers faced by export processing companies as well as fishermen. Processing companies are paying less attention to trade promotion in export markets such as investing in and organizing fairs, exhibitions and international conferences. This is also the case in domestic markets that supply materials for export processing.

Additional to high entrance barriers, exit barriers are also high, as existing processing companies have invested heavily in capital and technology (such as the floating cages for raising Pangasuis). In An Giang province, some processing plants are rushing to sell their cages as the market for Pangasius becomes unstable. (Information provided by to Buu Huy, deputy director of An Giang Import-Export Foodstuff and Agriculture Product Company (Afiex), as well as the director of Afiex Refrigerator Aquatic Product Enterprises). The deputy directory of Afiex confirmed that the company urgently needs to sell 20 fishing cages at any price, even if it results in a loss. However, it is very hard to sell cages as it costs approximately VND 300 million to build a fishing cage with the capacity to turn out 100 tons and with the same amount of money, it is possible to buy 1 ha of land to dig ponds for raising Pangasius. With ponds, fishermen are able to control the water source more effectively. An Giang Fisheries Association (AFA) statistics that showed there were approximately 2,000 fishing rafts in the whole province in 2004, nearly 50 percent less than 2003. This number is likely to continue to fall and consequently may result in

the end of the raft fishing industry. A reason for this is that Pangasius that were raised on fish rafts were previously known to have the best quality and price. However, during this time fishermen did not fully understand the techniques for breeding white meat Pangasius in ponds. Nowadays, fisherman are able to breed the Pagasuis properly in ponds, and as the cost of using fishing rafts is greater than raising fish in ponds, fisherman who use ponds are able to supply a similar product at a lower price. An additional problem with raising Pangasius using fishrafts is that there is often a lack of light and an uncontrollable water environment. Consequently, fish breeders choose to invest more in ponds rather than floating cages.

In 2000, due to the attractiveness of export markets, most companies have ignored the domestic market. However, since the introduction of technical and trade barriers in the US market, companies have begun to look to the domestic market again. According to Khanh (Vice chairman of AFA) AFA in accordance with An Giang Department of Trade, has begun to establish a delivery network in Ho Chi Minh city and until 2005 there were at least 4 companies participating in the program. The result of this is that the domestic market is more competitive and attractive to processing companies.

In short, there are high entrance and exit barriers in the Pangasius industry. Consequently, it is difficult to attract new processing companies into the Pangasius industry. However, as there are still 27 processors in the MD, the market is still a competitive market.


**Fishermen**
The entrance and exit barriers faced by fishermen raising Pangasius is quite low as switching costs are low and money can be borrowed from banks in order to build floating cages and purchase equipment and technology. Fisherman can borrow more than 200 million VND to build one floating cage. According to An Giang Provincial Department of Agriculture and Rural Development, the province's Pangasius farm area had expanded to 1,016 ha by April 2005, 35% more area than in 2004. This is due to the fact that a lot of local farmers thought it was a good idea to follow the trend and start fish farming. Several locations such as Soc Trang, Ca Mau and Tra Vinh provinces that were engaged in shrimp farming, switched over to farming Tra fish. However, in September 2005, 30-50% of fishermen in the MD stopped raising Pangasius completely or transferred to raising other types of fish. The competition amongst fish farms has been rather high, especially when Pangasius was being oversupplied.


### 3.3.2 Degree of product differentiation
Pangasius is the general name for basa and tra fishes. Basa fish is Pangasius bocourti, one of 21 species belonging to the Pangasiidae family of catfish. Pangasiidae is found throughout most of Southeast Asia. Basa is a relatively

tasty fish, with a delicate texture and nice white flesh. The fast-flowing water of the Mekong River gives basa meat a cleaner taste than most local freshwater fish, which are raised in stagnant ponds where algae impart a noticeable flavor. In addition to Pangasius bocourti, Vietnamese fish farmers started farming another member of the Pangasiidae family, Pangasius hypothalamus, which was known locally as tra fish. Compared to basa, tra is considered somewhat inferior eating, with thinner fillets and a coarser texture. Tra is a hardier fish that doesn't require expensive aeration, and the species is easier to spawn in captivity. It is also faster growing and cheaper to produce. In just eight to 10 months, tra grows to almost 3 pounds, big enough to yield two 8-ounce fillets. Fillets cut from basa are whiter than fillets cut from tra, which tend to be more beige. Also, basa have a more delicate flake than tra, which tends to be grainier in texture. Frozen basa and tra fillets are usually sold in 10-kilo shatter packs or IQF in 15-pound boxes[6].

For business purposes there are two main classes of Pangasius, class one and class two. Class one Pangasius weighs greater than 700g and class two Pangasius weights less than 700g. In addition, people often classify Pangasius based on size, color and quality in order to identify a buying/selling price. In fact, processing companies will take samples of Pangasius from fish farms and test them based on criteria such as antibiotics, quality and color of the meat before making a purchasing decision.

The results of analysis in this part show that Pangasius sold in domestic and exported markets are rather homogenous. Product differentiation is based on the color and quality of meat. Therefore, we can conclude that product differentiation is not expected to be a barrier for competition.


## 3.4    THE PROCESS OF PANGASIUS PRICE FORMATION

Generally, Pangasius price is determined by negotiation between Pangasius breeders and traders. Before selling Pangasius, fish breeders usually collect price information from neighboring sellers or from public media such as TV, radio or brochures of market information provided by the Department of Agriculture. However, farmers usually gain a price 500-1,000VND/kg lower than market price. One of the reasons to explain this is that the announced price is collected from processing companies, while the fish breeders sell Pangasius at farm gates. Thus, the difference on price can be considered as loading costs.

In addition, over half of the production of Pangasius is exported to the US, Europe, China, Russia and Japan, so Pangasius price depends strongly on export markets. Therefore, the processing companies will base their prices on the export market price when negotiating a price for traders or fish breeders. In some cases, when farmers need money and consequently need to sell Pangasius

---

[6] *Diversified Business Communications, Basa Catfish*

immediately, they will offer the fish at a much lower price. Sometimes, fish breeders even accept to sell Pangasius at the break-even point or even at a loss. In short, the process of Pangasius price formation depends on international market price as well as processors who are price setters (that is, they are key players in the marketing channel).

# 4. GOVERNMENT POLICIES AND REGULATION FOR THE PANGASIUS INDUSTRY

## 4.1 MARKET INFORMATION

On 17 May 2002, the Minister of Fisheries issued decision No 15/2002/QD-BTS in relation to "Control residual antibiotics in raising animals and aquaculture". An issue signed by Nguyen Thi Hong Minh, Vice Minister of Fisheries. Unfortunately, the implementation and information diffusion to fisherman and export processing companies around this decision was not conducted well. As a result, some processing companies had trouble with residual antibiotics when exporting Pangasius products to the US market during 2003.

On 15 August 2005 the U.S. Food and Drug Administration (FDA) press released the document "Vietnamese Basa Banned in Mississippi". Prior to 18 August 2005, the Ministry of Fisheries had issued decision No 26/QĐ-BTS announcing 11 kinds of antibiotics which are forbidden for use in processing fish to be exported to the US and North America. However, because of a breakdown in communication, the announcement did not reach the fishermen. As a result, fishermen still used antibiotics when feeding Pangasius. On August 19 2005, Le Dung, a Vietnamese Foreign Ministry official stated that Vietnam's control over antibiotics aquaculture is similar to regulations in Europe, the U.S. and other markets such as Japan, Canada, the Republic of Korea and Switzerland. On August 21, 2005, the Fisheries Ministry added Fluoroquinilones to the list of chemicals prohibited in aquaculture.

Regular inspections are conducted at farms and processing facilities to ensure all the banned substances are not used. The National Fisheries Inspection and the Quality Assurance Center monitor adherence to this ban in 32 provinces.

Local authorities have urged farmers to report fish breeding activities and sign contracts with processors in order to minimize risk. However, most farmers have chosen to avoid the headaches and expenses involved in getting official permission and registration. (In such a situation, it is impossible to access production figures for Pangasius and over supply is unavoidable).

The Ministry of Agriculture and Rural Development issues a newspaper every month. In addition, each provincial department of Agriculture and Rural Development has its own press. The main activities of the press is to supply information about agricultural activities, market information, government

policies, etc. to a diverse audience including the Provincial Committee as well as Leaders of Provinces, districts, villages, cooperatives, the Extension Club, and the Excellent Farmer Club. However, the information is generally updated too late. In particular, market information, which is only issued once a month. The press also uses very technical terminology that is difficult for farmers to understand.

Another source of market information is radio. In the MD, radio is one of the main media sources for market information for fishermen. There is a market information program after the news every morning and/or evening as well as in the weekend where there is a weekly market summary.

Specifically, in An Giang province, there is only one Unit of Market Information belonging to the An Giang Department of Agriculture. This unit has responsibility for collecting market information in relation to key products from different sources such as prices at local markets and prices of export.

Fish price is usually set by negotiation between farmers and traders. However, before selling fish, farmers usually refer to the selling prices of other farmers in the same village or from traders. Sometimes, farmers compare with the fish prices announced on TV, radio or in market information brochures provided by the Unit of Market Information (An Giang Department of Agriculture).

In short, market information is not well established nor frequently updated. Key players in the Pangasius industry face difficultly in accessing up-to-date market information as quickly as possible.

## 4.2  TAX POLICIES

To aid aquaculture in Vietnam, an instrument to overcome structural problems and to regulate overall developments in the sector has been introduced. According to decision No 51/1999/NĐ-CP issued by the Government on 08 July1999 in relation to Implementation Encouraging Investment Law, anyone who invests in poor regions with weak infrastructure facilities – thereby creating jobs – is free from land tax and income tax. For example, during the first four years after the announcement, investment in some areas – such as the building of hatcheries – was encouraged by low interest loans of up to $3,200. In additional, bureaucratic license procedures for new farms has been simplified.

## 4.3  FINANCING POLICIES

A key document is the circular letter No 82/2000/TT-BTC from the Ministry of Finance regarding "Financing policy guidelines to develop economic farming" issued on 14 August 2000. This states that: Investment on building processing factories which process aquaculture products are entitled to receive a loan and support with preferential interest from the Development Funds. Therefore, processing companies have the advantage of loan finance during the first stage of investment.

108

At the initial stage of fish farming, most farming households have to borrow money from the Bank of Agriculture and Rural Development, Commercial Banks or Credit Funds in order to build ponds or purchase cages as well as to buy fingerlings and other facilities. Survey results indicated that fish breeders generally have to pay market interest rates of 0.5 to 1.2% per month depended on the credit organization. Loan sizes depend on the scale of production and whether ponds or cages are utilized. Normally, the maximum loan size for a household is VND 100–200 million. Therefore, many households source additional loans from family members, friends or from "hot credit" sources (with high interest rates, 5-10% per month). All banks require collateral for loans, such as property ownership or a land certificate. Unfortunately, as money is limited, fish breeders' demand for loans is 1.5-2 times higher than the loan amounts currently being supplied. In some cases, fish breeders can access funds for feeding from export processing companies based on business contracts or existing relationships. Thus, loans from the financial organizations become less crucial.

In 2003, companies that increased exports were supported by a Ministry of Finance fund. Consequently companies have invested considerable sums in the processing sector and increased their production of value added products. For example, Agifish, one of the leading Pangasius processors in the region, invested 1.3 million US dollars in the expansion of its processing lines. It has produced 60 value added products from Pangasius. Another company, Afiex, has enlarged its processing section, added to its frozen storage capacity and produced over 30 value added products from Pangasius.

In August 2005, three US states (Alabama, Louisiana and Mississippi) banned the import of basa catfish from Vietnam. The reason being that catfish might contain flouroquinolones, a class of antibiotics unapproved for food-use in the US. As a result, thousands of Vietnamese fishermen faced bankruptcy. The price of raw catfish plunged in the MD and fishermen tried to sell their stock to avoid a further fall in price. Fisherman also still faced the debts owed to banks which needed to be repaid. Nguyen Huu Khanh, vice chairman of the Vietnam Fisheries Association (VFA) said that the VFA would open talks with local banks to persuade them to continue offering low interest loans to catfish farmers (approx. 0.5-0.85% per month) or delay the payment period, so that fish breeders could continue to produce.

In short, financial policies have strongly affected processors and fish breeders, particularly loan and interest rate policies. Most fish breeders depend on loans from banks during the production process, and consequently are concerned with interest rate fluctuations.

## 4. 4 GOVERNMENT POLICIES AND MONITORING

### 4.4.1 At a national level

Since the 1990s, the fishery industry has been watched by the government in order to create policies which will help develop the industry. As a result decisions have been issued such as: Decision No 224 on fishery development in the period of 1999 – 2010 and Decision No 80 on associating the stakeholders in the business process.

On 15 June 2000 the government released a circular letter guideline implementation decision No 09/2000/NQ-CP of Government regarding "Some policies to transform economic structure and consume agricultural products" issued on 13 November 2000 and signed by Nguyen Viet Thang, Vice Minister of Fisheries. According to this document, the fishery industry needs to invest strongly in following fields over the next ten years: exploiting, feeding, processing, services (especially sustainable feeding aquaculture) and increased aquaculture exports. Total planned aquaculture output in 2005 and 2010 is targeted 2,450,000 tons and 3,400,000 tons, respectively. Additional to these target numbers, planning for raising aquaculture in 2005 and 2010 is 1,150,000 tons and 2,000,000 tons, respectively. During 2000-2005, the fish industry exported 2.35 million tons of seafood and earned $11 billion in exports. The country has a total of 410 seafood processors.

The government has encouraged raising fish in floating cages in An Giang, Dong Thap and Can Tho provinces. It is also necessary to update to new technology and improve current processing factories in the MD such that firms can process the various kinds of aquaculture product required on the export markets. Nationally, 80 export processing factories need to be improved and 20 new factories need to be built based on international standards. These factories must also use quality management systems such as GMP, SSOP and HACCP.

Until recently, the Ministry of Fisheries published a plan to increase Pangasius production to one million tons per year during 2005-2010. However, with supply exceeding demand in the Pangasius market in 2005, Viet Nam has set forth a new target to keep Pangasius output at around 500,000 tons annually.

One reason for surplus supply is that the fresh water fishery in the MD is primarily organized by locals and not by a formal organization. Therefore, local authorities are not able to accurately estimate of the actual output of each province. Generally, the Viet Nam Fishery Association (VFA) has discussed extensively the need to encourage more cooperation between the State, scientists, enterprise and farmers. However, because of a lack of legal regulations, this cooperation has not been well implemented.

According to official reports from the Ministry of Fisheries on 30 August 2005 from a conference on industry competition, the fisheries industry expects to gain USD4-5 billion in seafood export value by 2010. VFA reports that in 2005, Vietnam expects to earn USD 2.5 billion in seafood exports to 80 countries and

to become the seventh largest seafood exporter on the world market. Up until August 2005, Viet Nam gained USD 1.63 billion, an increase of 13% over the same period the previous year, even though seafood exporters had difficulty exporting their products to key markets. 60% of Vietnamese fish products are now consumed in the EU, 30% is consumed in Asian countries and Mexico and only 10% is consumed in the US.

The fisheries industry is focusing on building a national brand name and quality standards for Vietnamese seafood at domestic and foreign markets. The industry is also currently making an effort to introduce products to areas around the country and build fish markets nationwide. Ministry has also asked domestic seafood producers to increase the range of products as well as the volume for the domestic market via supermarkets and restaurants. In short, VFA needs a long term domestic distribution plan because many regions, especially remote ones, have not tasted this delicious fish.

### 4.4.2  At a regional level

Local trade authorities have helped Pangasius producers to promote domestic trade and seek new overseas markets. For example, An Giang People's Committee sent samples of aquaculture products – including Pangasius products – to commercial agencies in the U.S. and EU in order to promote the products and build good business relationships. In the long term, supervision over antibiotics use in seafood farms will need to be tightened. In October 2005, an inspection in several MD provinces will be launched. Furthermore, the Ministry of Fisheries has released a list of 28 chemicals and antibiotics prohibited for use in fishery farms, and another 28 that may only be used in limited quantities.

Due to the oversupply situation in 2005, the Minister of Fisheries, Ta Quang Ngoc, issued a decision that established a Board of Pangasius Production Control in the MD. The board was created to coordinate production management, productivity capacity, product quality, competition and export possibilities for Pangasius between the breeding provinces. Ta Quang Ngoc signed a decision to establish an Executive Board on Producing and Consuming Pangasius in Vietnam. There are 11 members of the executive board, including Ministry of Fisheries officials, members VASEP and VFA, and people's committee authorities from provinces where fish are bred in the MD. In addition, 14 officials from provincial departments of fisheries and from processing and exporting Pangasius companies will assist the executive board in it's tasks. The executive board is assigned to give guidance to the fisheries industry and to organize programs such as quality evaluation and trademarks of Pangasius in Vietnam during 2005-2010. The board can decide which measures should be taken to keep the market for Pangasius stable in the MD

### 4.4.3 At a provincial level

Generally, the Provincial People's Committee (PPC) and different departments under the PPC are responsible for the management and promotion of economic development of different sectors in the province. The PPC provides guidelines for fishermen, the designation of areas, the estimation of productivity as well as the capacity of factories to encourage fishermen to raise Pangasius.

In early 2004, the Department of Agriculture and Rural Development in An Giang Province has cooperated with the province's Department of Commerce and Tourism to sign an agreement on the price of material procurement within 5 provinces, namely Dong Thap, Can Tho, VinhLong, SocTrang, and Tien Giang. The agreement aims to protect fish breeders and fight against price coercion for households.

The An Giang Fisheries Association (AFA), which includes representatives of fish farmers (who are the key to stabilizing development of fisheries in this region and act as the bridge between households and factories), has been established to help in terms of productivity, needs of the market, and negotiating with banks to increase loans for members. The AFA has attracted more than 800 members from numerous economic sectors (mostly fish farmers). People contributed more than VND 20 billion (USD 1.2 millions) to establish the An Giang Fisheries Association's Joint Stock Import-Export Company (AFASCO) in order to ensure the availability of fish material for processing and exporting and to create stable income for all members in fish production. AFASCO cooperated with SIPPO of Switzerland to learn how to raise ecologically sound fish in order to meet the new requirements of demand. The ministry also set up the Pangasius processing management board in order to coordinate the industry throughout the entire region. Pangasius is the strength of the MD region, consequently the ministry supports the efforts of provinces to specialize in the production and exportation of this fish, consequently each region is required to have it's own trademark product.

The government has encouraged processors to look for new markets other than the US market and to focused on diversifying their product range in a bid to increase sales in the domestic market. For example, Agifish markets about 5-10 new products monthly, this helps increase the company's sales on the domestic market by 15-20% a year. Domestic sales account for more than 10% of total revenue of 40 million USD. In 2005, Agifish supplied over 100 Pangasius-based products through a system of sales agents across the country[7].

In 2005, in order to prevent farmers from facing high levels of risk, the AFA and the An Giang People's Committee proposed that no more processing plants should be built. There is now a target to keep domestic Pangasius output at around 500,000 tons per year – half of the Ministry of Fisheries' previous call for one million tons of Pangasius annually during 2005-2010.

---

[7] Ngo Phuoc Hau, Chairman of the company's Management Broad

# 5. VALUE-CREATED IN THE PANGASIUS MARKETING CHANNELS

This section provides an analysis of marketing costs, price margins, and profitability among each actor in the Pangasius marketing channel in order to identify the value-created. Primary and secondary data will be used to estimate the average price of Pangasius at different market levels. The average margins for all actors in the Pangasius marketing channel can then be computed.

## 5.1. ANALYSIS OF MARKETING COSTS AND MARGINS

### 5.1.1 For Pangasius breeders

In 2004, the price of Pangasius was VND 15,000 per kg. Up until September 2005, the highest price a farmer could sell at was VND 10,200 per kg. Prior to 2002, raising Pangasius was one of highest income occupations in rural areas with benefits of approximately 80% of the production costs. More recently, due to a decrease in export prices and increased cost of feed, fuel and material costs, the benefits from fish farming have dropped remarkably. Table 7 shows that harvesting one ton of Pangasius costs approximately VND 9.88 million (with the largest proportion going to feed) and the gross margin is around VND 119,000 per ton of Pangasius.

**Table 7:    Cost and gross margin of farmers in Pangasius production**
          Unit: VND 1,000/ton

| Items | Cost |
|-------|------|
| Feed | 8,300.0 |
| Depreciation | 616.6 |
| Fingerlings | 596.8 |
| Veterinary medicine | 124.5 |
| Fuel | 96.8 |
| Other | 146.2 |
| Total cost | **9,881.0** |
| Selling price | 10,000 |
| Gross margin | **119.0** |

*Source: survey data*

### 5.1.2 For traders/collectors

Collectors or traders usually use their own ships or rent ships for transportation. It is estimated that transportation costs are around VND550 for a distance of 50 km. The people that load the fish have to guarantee its quantity until the processing companies or wholesalers weigh the Pangasius. Traders get a high gross margin, VND 242,000 per ton. They spend VND 1,058 thousand per ton,

of which transportation costs occupy the largest proportion (VND 550,000 per ton).

**Table 8:  Marketing cost and profit margin for traders**
      **Unit: VND 1,000/ton**

| Items | Cost |
|---|---|
| Transportation in selling process | 550.0 |
| Loss in trading process | 84.6 |
| Unloading | 79.3 |
| Harvesting | 74.0 |
| Classifying, packaging, loading | 63.5 |
| Transportation in buying process | 60.3 |
| Taxation | 42.3 |
| Depreciation (net, pump, barrel) | 37.0 |
| Commission to agents | 21.2 |
| Others | 45.5 |
| Total marketing cost | **1,058** |
| Buying price | 10,000 |
| Selling price | 11,300 |
| Marketing margin | 1,300 |
| Gross margin | **242** |

*Source: survey data*

### 5.1.3  For wholesalers

Wholesalers play a role as middlemen in the marketing process. The figure in table 9 shows that wholesalers pay marketing costs of VND 214,300 per ton of fish. The highest marketing costs include labor rent, selling ground and quarantine. The wholesaler usually only makes a gross margin of VND 185,700 per ton.

**Table 9: Marketing cost and profit margin for wholesalers**
**Unit: VND 1,000/ton**

| Items | Cost |
|---|---|
| Labor | 57.9 |
| Fee for renting the selling ground | 57.9 |
| Cost for quarantine | 45.0 |
| Depreciation | 12.9 |
| Taxation | 11.8 |
| Cost of electricity | 11.8 |
| Storage | 10.7 |
| Others | 6.4 |
| Total marketing cost | 214.3 |
| Buying price | 11,300 |
| Selling price | 11,700 |
| Marketing margin | 400 |
| **Gross margin** | **185.7** |

*Source: survey data*

### 5.1.4 For retailers

Retailers in the marketing process have to pay some marketing costs such as costs associated with selling and buying ground, market management, market place clean up and other costs. The figures in table 10 indicate that retailers have to pay marketing costs of VND 1,100 per ton of fish. It takes more effort for retailers to sell Pangasius than other actors. For this reason, retailers' gross margin is high, equal to approximately VND 1.2 million per ton.

**Table 10: Marketing cost and profit margin for retailer**
**Unit: VND 1,000/ton**

| Items | Cost |
|---|---|
| Total marketing cost | 1,100 |
| Buying price | 11,700 |
| Selling price | 14,000 |
| Marketing margin | 2,300 |
| Gross margin | 1,200 |

*Source: survey data*

Table 11 presents a summary of marketing costs and gross margins for actors in the marketing channel.

**Table 11:** Marketing cost and gross margin of actors in marketing channel
Unit: VND 1,000/ton

| Actors | Production cost and buying price | Selling price | Marketing cost | Gross margin |
|---|---|---|---|---|
| Farmer | 9,881 | 10,000 | | 119 |
| Trader | 10,000 | 11,300 | 1,058 | 242 |
| Wholesaler | 11,300 | 11,700 | 214.3 | 185.7 |
| Retailer | 11,700 | 14,000 | 1,100 | 1,200 |

From table 11 we can see that the retailer has the highest gross margin. Next is the trader. The fish breeder faces high risk in production. However, still gets the lowest gross margin of all actors in the marketing channel. In general, all actors in the marketing channel receive a positive gross margin.


## 5.2. ANALYSIS OF PRODUCTION COSTS AND PROFIT

In 2002, it was calculated by the Fisheries Ministry that if the price of raw material was of 14,200 VND/kg (approximate USD 1/kg) and there was a selling price of USD 3.61 –3.62/fillet kg (class 1) under the FOB prices, the processing enterprises will make a profit of USD 1.80/fillet kg.

In 2005, fish farmers faced difficulties in terms of production costs, which increased while the selling price of Pangasius decreased. The price of feed increased 2-3 times compared with a few years before. According to fish farmers, the price of bran was 3,000VND/kg and sea fish (which is used for feeding Pangasius) was 3,500VND/kg. In order to breed one floating cage of Pangasius for one day, there is a need for 600kg of bran and 200kg of sea fishes. Total feeding costs equal 2.5 million VND per floating cage per day. The production cost to harvest 1kg of Pangasius in the second quarter of 2005 ranged from 10,000-11,000VND/kg.

Before 2005, when the price of Pangasius was 7,000-8,000VND/kg, fish farmers gained more profit. In the second quarter of 2005, the price of Pangasius was 11,000VND/kg. However, fish breeders were still loosing money. This was the same in periods where the market price was 9,000-10,000VND/kg. During this period, it was even difficult for fish breeders to sell Pangasius at a break-even price. Processing companies purchased at less than 11,000VND/kg of class 1 Pangasius. However, fish-breeders could not easily leave the market as they had already invested a lot of money into feeding the Pangasius.

Fish breeders had generally taken loans from banks at an interest rate of 0.89% and when they could not sell the mature Pangasius, they had to loan further money from non-formal credit institutions with a 10%-15% interest rate, despite having already extended the pay back period from the banks one to two times.

## 5.3. THE DIVISION OF VALUE – CREATED IN THE PANGASIUS MARKETING CHANNELS
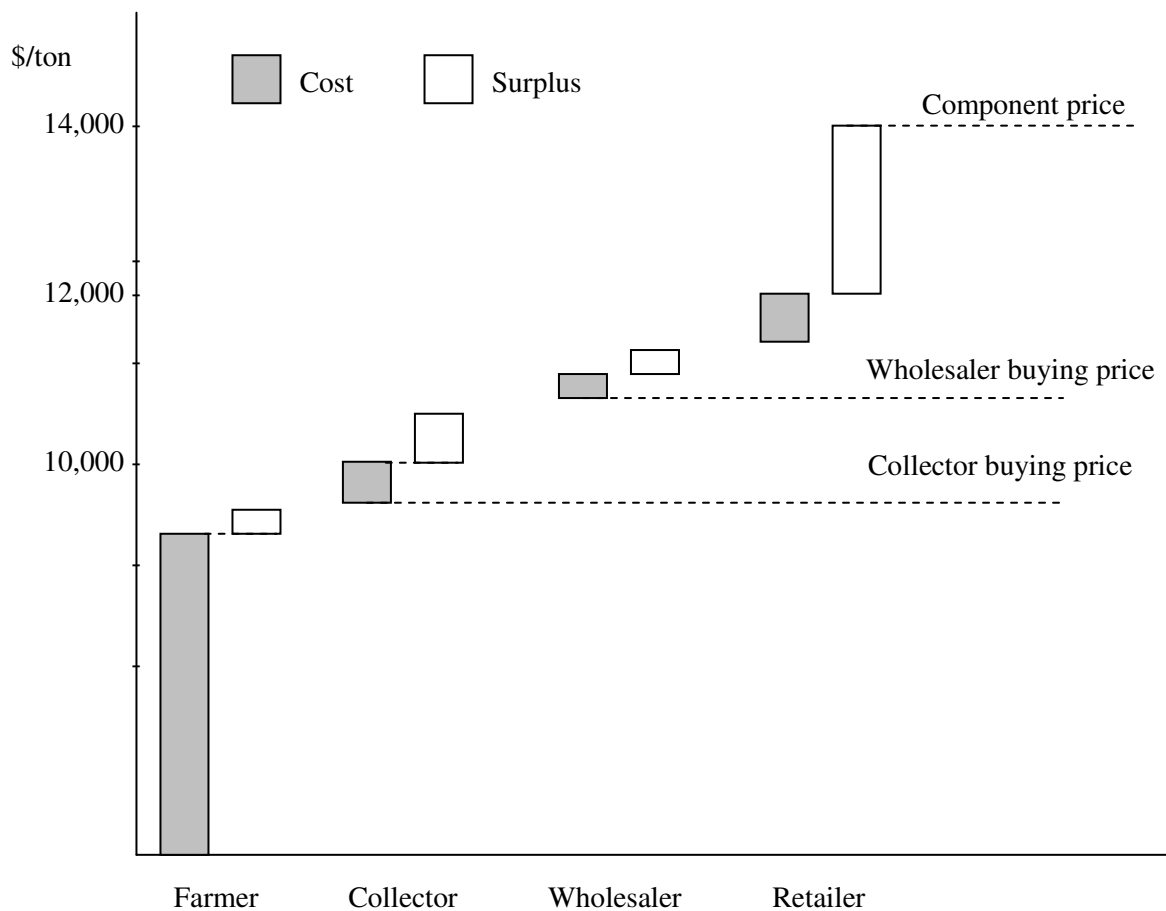


*Source: survey (2005)*

**Figure 5: Division of value – created in the production of pangasius industry**

Figure 5 illustrates the division of value–created in the Pangasius industry.. Pangasius breeders capture a relatively large proportion of value-created, but earn low profit.

Fish breeders face the highest risk in raising Pangasius. Retailers, by contrast, only capture a modest portion of the overall value-created. The retailer's portion of the market channel is characterized by strong price competition and high profitability. However, retailers also face high risk because of the availability of a large number of substitute products.

The highest percentage contribution to value-created comes from the breeding sector (who also face the highest production cost). This sector plays an important role in the Pangasius marketing channel but their relative profit is lower than other actors (as calculated using the Profit_Incremental cost ratio)

There are two ratios used to analyze the distribution of profit among actors in a channel:

$$\text{Profit margin\_total cost ratio} = \frac{\text{Profit margin}}{\text{Total cost}} \qquad (1)$$

$$\text{Profit\_Incremental cost ratio} = \frac{\text{Profit}}{\text{Incremental cost}} \qquad (2)$$

**Table 12:    The distribution profit among actors**
              **Unit: %**

| Actors / Ratio | Breeder | Collector | Wholesaler | Retailer |
|---|---|---|---|---|
| Profit margin_total cost ratio | 1.20 | 2.19 | 1.61 | 9.38 |
| Profit_Incremental cost ratio | 1.20 | 22.87 | 86.65 | 109.09 |

These ratios show the relationship between profit margins and total cost (or incremental cost) for each actor. The retailer has the highest percentage in both cases. The breeding sector has the lowest percentage in both ratios (Table 12).

## 5.4  THE TRENDS OF PANGASIUS PRICE

In 2003, America accused Vietnamese enterprises of dumping catfish. At the same time, Europe erected many technological barriers for Vietnamese catfish products. As a result catfish producers have faced fluctuations in market price. In October 2004, the price of Pangasius dropped from VND14,000-VND15,000 per kg to VND 9,500-VND 12,000 per kg (figure 4). Up until December of 2004, the price of Pangasius had reached VND 13,000 per kg. However, one reason for the increase in price of Pangasius during this period is the Tet holiday period, where demand in the domestic market is high.

**1,000 VND**
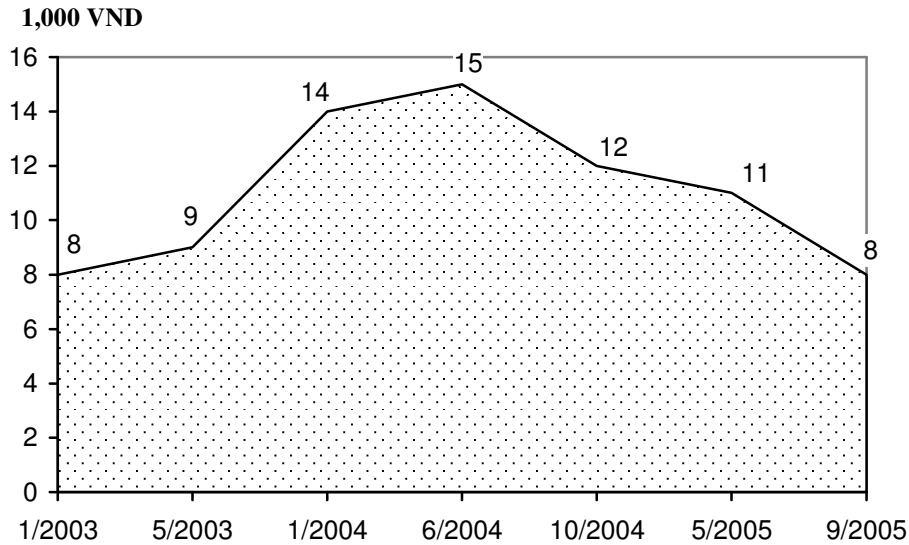
**Figure 4:    Market price of Tra and Basa fish in the period of 2003-2005**

Since April 2005, the price of catfish has remained low and in mid December 2005, three states in the United States prohibited to sale of catfish imported from Viet Nam. These obstacles are difficult to avoid. Initially, businesses sold catfish for $4 a kg. However, some reduced the price to $3, and for this reason Viet Nam farmers were accused of dumping the fish. In 2005, at a fishery fair organized in Belgium, a few large fishery outfits reduced the price of their products, as a consequence other suppliers had to lower their prices. These also lead to the price of Pangasius reducing in the months after that. In October 2005, the price of Pangasius dropped to VND 9,900-VND 10,200 per kg from VND10,500-VND11,000 per kg in June 2005

In short, Pangasius prices have a tendency to fluctuate and are likely to do so in the future. It will be difficult for fish farms and processing companies to handle these fluctuations if they only focus on foreign markets like the US.

# 6. CONCLUSION AND RECOMMENDATIONS

In recent years, the Pangasius industry has developing in the MD. This has led to change in market structure and performance of these products. The results of market structure analysis show that a high level of competition can characterize the Pangasius market in the MD. Pangasius sold in domestic and export markets are rather homogenous and product differentiation is not expected to be a barrier for competition. However, there are high entrance and exit barriers faced by processing companies in the Pangasius industry. Conversely, the entrance and exit barriers of fishermen are rather low.

The marketing channel in which Pangasius passes from fish breeders to final consumer is not particularly complex. The key players in the Pangasius marketing channel include fish breeders, traders, wholesalers, retailers, processing companies and final consumers. There are four main Pangasius marketing channels, of which the marketing channel from fish breeder to processing company is the most important. The breeder, trader, and wholesaler cannot access or update market information as quickly as preferred. The retailers is the actor with the highest one. Next are the traders and breeders. In general, all actors in the marketing channel display positive gross margin.

The Pangasius industry had been supported by Vietnamese Government through many decisions and resolutions in pushing up the growth of Pangasius industry and breeding Pangasius as well. All actors in the Pangasius marketing channel are strongly affected by fluctuations in price and the instability of world markets, especially the US and EU markets.

Market information in the Pangasius market is not well established and often updated late. Tax policy encourages the first stages of investment in breeding and processing Pangasius and financial policy strongly affects processing companies and fish breeders, especially loan and interest rate policies. At a national level, the Government has issued many decisions in order to help develop the Pangasius industry. In addition, at regional and provincial levels, the local authorities play an important role in pushing the development of the Pangasius industry.

*Some recommendations for actors and policy makers*
To reach the target of domestic Pangasius output of around 500,000 tons per year, the Ministry of Fisheries needs to be in tight cooperation with the Vietnam Association of Seafood Exporters and Producers (VASEP) in order to enhance trade promotion in domestic markets such as investing in and organizing fairs, exhibitions and international conferences. With a Vietnamese population of approximately 82 million, the potential demand for Pangasius is large. If the consumption of Pangasius products in local markets can be expanded, then the dependence on oversea markets can be avoided. In addition, The Ministry of

Fisheries is needed to help eradicate the problems in food hygiene and safety standards and improve the quality of seafood products.

It is recommended that VASEP as well as fishermen and processing companies should become members of the VFA such that all parties have representation and are able to cooperate, as working together is the only way to create sustainable mutual benefit. The VFA should also disseminate market knowledge and information on new feeding techniques to fishermen.

Legal regulation should also be created such that there is cooperation between the state, scientists, enterprise and fishermen. Enterprises play an important role in expanding consumer markets. They need to focus not only on export markets but also on domestic markets as domestic markets have a lot of potential.

This study has widened the understanding of Pangasius marketing channels, particularly for the domestic market in the MD. However, it still has some limitations that should be addressed in further research.

The first limitation is concerned with the weaknesses in the data. As a result, the study cannot address all the SCP elements. In particular, C elements are skipped in this study. Second, the sample size is fairly small and concentrates mainly on An Giang, Dong Thap, and Can Tho provinces. The samples may not cover all actors involved in the Pangasius marketing channel. A further study, could examine the different efficiency levels in the marketing channel. Third, with increasing value-added products, Vietnamese producers should be targeting the EU and US markets, as there are no penal duties on value-added products. On the other hand, processors' interest is also growing in the developing domestic market. Although frozen value-added Pangasius products will initially remain regional niche products, demand for such products is increasing. Such demand is developing in the large urban centers, in particular, where there is already a network of modern supermarkets and a financially strong middle class. Further research should examine how to expand the local market share significantly.

# REFERENCES

A fishy situation of supply and demand
http://www.ven.org.vn/view_news.php?id=4272

Aquatic product processor strives to boost domestic sales, 9/8/2005
http://www.vneconomy.com.vn/eng/article_to_print.php?id=5bf28451d019c
d

Basa fish processing http://www.marel.is/04000/article/fish_basa%20fish.asp

Circular letter about "Financing policy guideline to develop economics
farming" http://www.agrovoet.gov.vn/vnagroforestry/HTML/luat/cs82-
00.htm

Circular letter guideline implementations decision No 09/2000/NQ-CP of
Government on June 15, 2000 about "Some policies to transfer economics
structure and consume agricultural products".

http://www.agrovoet.gov.vn/vnagroforestry/HTML/luat/cs05-00.htm

Decision No 15/2002/QD-BTS about "Control residual antibiotics in raising
animals and aquaculture" on May 17, 2002
http://www.agrovoet.gov.vn/vnagroforestry/HTML/luat/cs13.htm

Delta fisheries need more central management, better distribution 4/10/2005
http://www.vneconomy.com.vn/eng/article_to_print.php?id=e4dfa16be8509
8*Diversified Business Communications, Basa Catfish*

Era of Basa, Tra raft fishing wanes, VNECONOMY, 2/11/2004
http://www.vneconomy.com.vn/eng/index.php?param=article&catid=0803&
id=041102101553

Fillet exports to the USA down by nearly 50%
http://www.globefish.org/index.php?id=2153&easysitestatid=1119592348

Fish farming of tra and basa fishes get trouble
http://www.vnexpress.net/Vietnam/Kinh -doanh/2005/05/3B9DE743

Fish farmers look for a way out
http://www.ven.org.vn/view_news.php?id=4556
http://www.fistenet.gov.vn
http://www.vvg.Vietnam.com

Huy, HT (2003), *Export promotion of fishery products the case of tra and basa
fish products in the Mekong Delta, Vietnam*

Son, NP (2003), *Market analysis of cultured Pangasius in the MDR, Vietnam.
Reorganize aquaculture production in the MD 21/9/2005*

Vietnam catfish farmers face ruin after US ban, 26/08/2005
http://www.vneconomy.com.vn/eng/article_to_print.php?id=14838414b482e
8

Vietnam has tight controls over antibiotics in fisheries
   http://www.saigontimesweekly.saigonnet.vn/issue35/vietnam_this_week.htm
Vietnamese processors developing domestic market
   http://www.globefish.org/index.php?id=2153&easysitestatid=1119592348
VN seafood industry aims to increase markets and quality
   http://www.vneconomy.com.vn/eng/article_to_print.php?param=article&cati
   d=0803&id=161204faf87e7d
Statistics yearbook 2004

# MARKET STRUCTURE AND MARKETING CHANNEL ANALYSIS: THE CASE OF SWINE IN THE MEKONG DELTA

**LUU TIEN THUAN**
**LUU THANH DUC HAI**

# 1. EXPLORATION OF THE PROBLEM

The Vietnamese economy's transition from a concentrated economy to a market economy has encouraged farmers to produce more agricultural products not only in an attempt to increase their income, but also to increase the contribution of farmers to GDP. The Mekong Delta comprises 4 million ha and more than 13 million agricultural laborers. Consequently, it has great potential when it comes to producing high value agri-products such as rice, aquatic products, animal feed and fruit.

In recent years, the consumption of agri-products from the MD in local and export consumption markets has increased rapidly, particularly rice, pork meat and aquatic products. However, there are many weaknesses in the production systems and distribution channels of agri-products. For example, product quality is low, there is price fluctuation, products are not consistently supplied at the right time and location and the distribution channel is highly complex. (Hai, 2004) These problems have negatively effected competitive efficiency in both local and interregional markets.

The present marketing system of agricultural products is very young as market liberation occurred relatively recently. Accordingly, not all market mechanisms are expected to be operational. Many buyers, sellers and middlemen are involved in the distribution channel, leading to high costs of distribution, lower prices for farmers and higher prices to final consumers (Hai, 2003). Many obstacles in the distribution channels of agricultural products need to be removed, particularly in the swine and chicken markets.

The development goals of the Vietnamese government over the next few years include:
- An increased volume of swine production for domestic consumption and processed pork for export markets.
- Consistent and efficient methods of pork marketing and at competitive market prices.
- Improved channels of distribution at regional and interregional levels[2].

To attain these goals, adequate information on market structures, conduct, and performance in the swine industry is required. This market knowledge will also be useful to researchers and policy makers in developing a marketing program for the country's swine industry. Information on marketing practices, costs, and margins can also help in identifying the weaknesses in the market for swine in Vietnam, providing planners and policy makers with the necessary information to formulate strategies and market alternatives geared towards the improvement

of the swine marketing system. The aim of this study is to create a general picture about swine marketing channels in the MD as well as to identify some issues for further research.


## 2. RESEARCH QUESTION

The study: *"Market Structure and Marketing Channel Analysis: The Case of Swine in the Mekong Delta"* was conducted to answer the following questions:

General question:

• What is the situation of the swine distribution channel in the MD?

Specific questions:

• How effective are the marketing channels in the MD?

• What is the level of value-created in marketing channels in the MD?

• What issues/topics need to be further researched?


## 3. RESEARCH OBJECTIVES

With globalization and high levels of competition, it is necessary to know the effectiveness and value-created in swine marketing channels in order to create a general picture of the market. The research focuses on domestic market structures as well as the relationships between different intermediaries in the market and tries to assess the effectiveness of the market services supplied. The results of this study are used to provide recommendations for further research to improve swine distribution channels.


## 4. ETHODOLOGY / THEORETICAL FRAMEWORK

In this study, the SCP approach is integrated with the marketing channel approach and the division of value-created approach. These approaches are used as guidelines in identifying the different aspects of the problem.
According to the SCP model, there is a dynamic relationship between market structure, conduct and performance. Market structure and market conduct influence market performance. In turn, market performance will influence market structure and market conduct in the long run (See Figure 1 below). Performance, in particular industries or markets depends upon the conduct of sellers and buyers with regard to pricing policies, product line, investment in

production facilities, and so on. Conduct depends in turn upon the structure of the relevant market, including such features as the number and size distribution of sellers and buyers, the type of marketing channel, the degree of product differentiation, the presence or absence of barriers to the entry, etc.
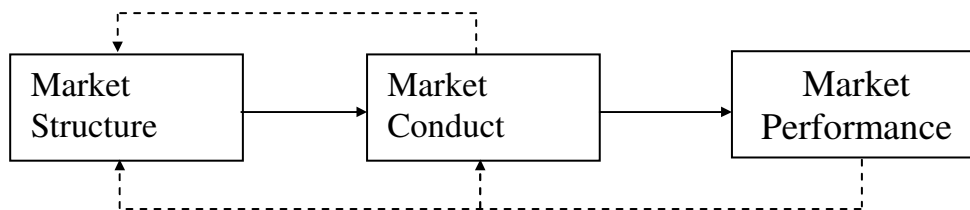


**Figure 1:    Dynamic model derived from the SCP approach**

In his 2003 paper, Hai applied the SCP model and integrated some concepts of the theory of institutional economics and the marketing channel approach. Table 1 presents the principal aspects used by Hai.

Table 1:    Elements of Structure-Conduct-Performance

| Elements of structure | Elements of conduct | Elements of performance |
|---|---|---|
| - Intermediaries involved in the marketing system<br>- Barriers to entry and exit<br>- Buyer and seller concentration<br>- The assortment of product quality<br>- Distribution of market information<br>- Structure of marketing channels<br>- Price formation process<br>- Rules and/or regulations that coordinate market exchange. | Conduct with respect to:<br>- Buying<br>- Selling<br>- Transport<br>- Storage<br>- Negotiation<br>- Processing<br>- Information<br>- Finance/risks bearing<br>- General trading strategies that traders conducted in order to follow market rules and increase marketing efficiency (reduce transaction costs) | - Effectiveness of supplied services; product suitability in relation to consumer preferences<br>- Efficiency of supplied services<br>  + Rate of profit in relation to marketing costs and price margins (arbitrage in time, space and form).<br>  + Transaction cost analysis (market searching; negotiating and concluding a contract; enforcing a contract)<br>+ Analysis of price differences and seasonal price fluctuation<br>+ Market integration<br>- Dynamic analysis of the market process |

*Source:  Hai LTD, 2003, p. 26*

As thousands of producers and collectors are involved in the swine market, we can assume that competition is high. Therefore, there is not much room for actors in the market to behave independently as they have to follow the market rules as defined by structural elements (Bain, 1968). In this paper, the element of "buyer and seller concentration" will not be considered as thousands of breeders are small scale producers and hundreds of traders and slaughter houses are small scale traders and small enterprises. Therefore, buyer and seller concentration is not a relevant element and will not be used in this study. In

addition, in analyzing the elements of performance, due to data limitations, this paper will not evaluate the efficiency of marketing channels, market integration, transaction costs and seasonal price fluctuation. In Hai's model, one of the components used is an analysis of "margin". We also apply this method and use the results to analyze the distribution of value-created among actors in the supply channel. Consequently, table 1 was modified into table 2 which contains the elements under study in this paper.

**Table 2:** **Modified Elements of Structure and Performance**

| Elements of structure | Elements of performance |
|---|---|
| - Intermediaries involved in the marketing system | - Effectiveness of marketing channels; supplied services; product suitability in relation to consumer preferences |
| - The existences of entry and exit barriers | |
| - The assortment of product quality | |
| - The distribution of market information | - Value-added and value created analysis to identify where the economic value is created within a value chain. |
| - Price formation process | |
| - Rules and/or regulations that coordinate market exchange. | |

**Elements of market structure**

For market structure, actors/intermediaries involved in the marketing system were examined by visiting market places and interviewing actors in the marketing channel. The information gathered was used to define a general picture of the channel. The term intermediary refers to any channel member other than the manufacturer or the end-user. The marketing channel information is also integrated into the first element of market structure (actors/intermediaries). Marketing channels are defined as the flow of products from the place of production to the place of ultimate consumption. Marketing channels help to determine the relationships between different actors in the markets.

The next step was to focus on competition by using three major criteria: the existence of entry and exit barriers, the assortment of product quality and distribution of market information.

- The existence of entry and exit barriers influences the competitive relationship between firms and potential entrants. If the barriers to entry and exit are minimal, new firms can easily enter into and exit from the swine markets and compete with established firms. However, with the presence of very high barriers, established firms become well protected from potential rivals (Kotler, 2004). There are three main types of structural entry barriers: (1) Control of essential resources: an incumbent is protected from entry if it controls a resource necessary for production; (2) Economies of scale and scope. When economies of scale are

130

significant, established firms operating at or beyond the minimum efficient scale will have a substantial cost advantage over smaller entrants. Economies of scope in production stem from the flexibility in materials handling and scheduling that arises from having multiple production lines within the same plant. Economies of scope in marketing are due to substantial up-front expenditures on advertising that are needed for a new entrant to establish a minimum acceptable level of brand awareness. Economies of scale and scope create barriers to entry because they force potential entrants to enter on a large scale or with many products to achieve unit cost parity with incumbent firm; (3) marketing advantages of incumbency. Exit barriers arise when firms must meet obligations whether they produce or not (Besanko, 2004). In the case of swine, the entry and exit barriers will be measured by (1) control of essential resources (raising techniques, labor force); (2) Capital requirement; and (3) marketing advantages of incumbency (low demand, fluctuation of market price, market information).

- The assortment of product quality examines the extent to which sellers differentiate, distinguish or express their specific preferences among competing products of the various sellers. Factors such as product quality and kinds of product marketed are common attributes of product differentiation. In the case of swine, product differentiation both at the farmers' and the traders' level are examined in terms of different kinds/qualities of swine; degree of weight; and different types of swine variety (local swine, hybrid swine and foreign swine varieties). The quality of swine will depend on genetics and animal health. The quality of pork meat is measured by the color of meat, the amount of fat and health of the swine.

- The distribution of market information refers to the availability of relevant market information. This could be expressed by assessing the producers' awareness of the market price, the manner by which price information is disseminated among producers. The distribution of market information shows how market information is disseminated to producers and traders, what/who are the sources of market information, and the adequacy of this information in terms of risk reduction.

The process of price formation is determined by the following fundamentals: market power, bargaining skills, and transaction specific characteristics such as quality of the product, volume of sales per transaction, and sales location. In general, a large trader usually has high market power when setting prices in the market. The Quality of the product is related to consumers' preferences. Sales volumes express the sales of traders and retailers. Finally, sales location will directly effect the price of a product as transport costs may be significant.

Rules and/or regulations that coordinate market exchange: focuses on a description of the role of government in the swine market and major policy and

regulation changes to promote swine trading.

**Elements of market performance**
Analyzing market performance we focus on the degree of effectiveness in the marketing system.

*Effectiveness* means that marketing channels offer proper service outputs. It means that the distribution channel meets the demand for services expressed by consumers. First of all, the marketing channel has to provide the following generic services: exchange functions (ordering, assembling, negotiation, market information, payment and distribution), physical functions (storage, processing, transport) and facilitating functions (grading, financing) (Coughlan, 1996). In the case of swine, the key functions of generic services will be examined to discover whether each function is working well. The swine marketing channel evolves because end-users (both business-to-business buyers and individual consumers) usually prefer to deal with a marketing channel that provides higher service outputs such as bulk breaking, spatial convenience, low waiting and delivery time and product variety.

*Bulk breaking*: refers to the end-user's ability to buy its desired (possibly small) number of units of pork meat, liver, etc. even though they may be originally produced in large, lot sizes.

*The spatial convenience factor* of the service output mainly refers to the distribution of wholesale and retail shops as well as the availability of transportation services. According to gravity models used in marketing research, the attractiveness of wholesale and retail shops to consumers is related to their location. Wholesalers and retailers in the case swine trading usually choose their shops at places that are convenient for transport, loading and un-loading the product (space for parking, near the main roads or canals), or at a central place that customers can easily visit in order to attract more customers.

*Waiting and delivery time*: is defined as the time period that the end –user must wait between ordering and receiving goods. The wider the breadth of assortment or the greater the product variety available to the end-user; the higher is the output of the marketing channel system and the higher are overall distribution costs, because greater assortment typically entails carrying more inventory.

*Division of value-created*

Value-created is the difference between the benefit *B* and the unit cost *C* of the product. Value-added analysis is a tool for understanding where economic value is created within a firm's value chain.
The value-added analysis proceeds as follows:
- Value-added in manufacturing = profit that would have been made if all products of the producer are sold to the next actor in the channel

- Value-added in distribution = incremental profit made by self-distributing products to retailers or to wholesalers (Besanko, 2004, 418-419)

**Figure 2:  Division of value – created in the production of one industry**
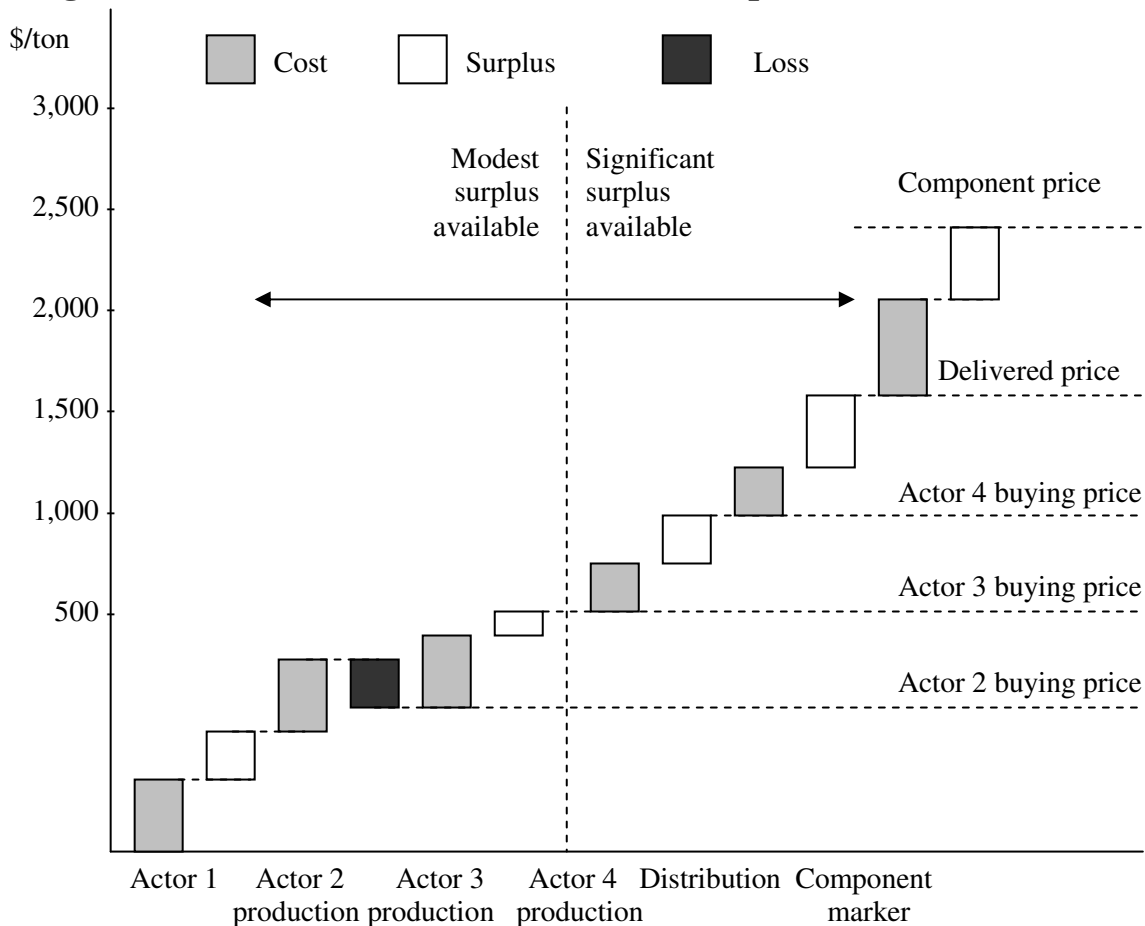


*Source: Adapted from Figure 11.11 in Besanko et al., 2004, pp. 382.*

Figure 2 illustrates the division of value-created in one industry. Actor 1, 2 and 3 capture only modest portions of the overall value-created. They are characterized by strong price competition and low profitability. Distributors and actor 4, by contrast, capture a relatively larger proportion of value-created and earn high profit.

Division of value-created will be applied in the case of swine. Each actor in the swine marketing channel will be analyzed based on their production costs, incremental cost and marginal profit in order to define the distribution of profit among actors. Two ratios will be used in analyzing: profit margin_total cost ratio and profit_incremental cost ratio.

$$\text{Profit margin\_total cost ratio} = \frac{\text{Profit margin}}{\text{Total cost}} \qquad (1)$$

$$\text{Profit\_Incremental cost ratio} = \frac{\text{Profit}}{\text{Incremental cost}} \qquad (2)$$

These ratios will show the relationship between the profit margin and total cost (or extra cost) that each actor earns. A comparison between these ratios for each actor in distribution channel will be performed to determine which actor has a higher percentage of profit in order to identify reasons why the profit of each actor is distributed differently. It will also form the basis for further research.

Primary data is collected to estimate the production costs of producers; marketing costs and marketing margins of various traders. From these results, total cost and total-marketing costs of various marketing channels can be calculated. Direct marketing costs include transportation costs, electricity and water costs, rent selling-buying ground and processing costs. The percent share of each cost item for each type of trader is computed.

Secondly, 'profit margin' measures the rate of return on gross sales after all costs involved in rendering marketing services are deducted. The profit margin will be calculated as follows:

| Profit margin of each type of trader | = | Total marketing margin of each type of trader | - | Variable marketing cost of each type of trader |
|---|---|---|---|---|

## 5. DATA DESCRIPTION

The data concerning the different sectors involved in the Vietnam swine industry such as the breeding sector, processing, distribution and marketing sectors, the financial system interface, and the public sector, were gathered from different sources including interviews with people in each sector.

The survey was conducted in four swine-producing provinces: Tien Giang, Vinh Long, Soc Trang and Hau Giang provinces and Cantho city. These provinces each had a different scale of swine production. Survey were conducted by interviewing 150 swine producers, 30 assemblers and 20 slaughter-houses. A total of 200 respondents were selected and interviewed using convenient sampling method.

Statistical data such as the quantity of swine were gathered from the General Statistical Office and other government agencies. Descriptive statistics such frequency were used to identify the main factors of swine marketing channels. This paper does not analyze the efficiency of marketing channels, market integration, transaction costs, price differences or seasonal price fluctuations. The study also does not consider foreign trade or the supermarket system.

**Southeast**
  42   Ninh Thuan
  43   Binh Thuan
  44   Binh Phuoc
  45   Tay  Ninh
  46   Binh Duong
  47   Dong Nai
  48   Ba Ria - Vung Tau
  49   Ho Chi Minh City
**Mekong River Delta**
  50   Long An
  51   An Giang
  52   Tien Giang
  53   Dong Thap
  54   Vinh Long
  55   Ben Tre
  56   Can Tho + HauGiang
  57   Tra Vinh
  58   Soc Trang
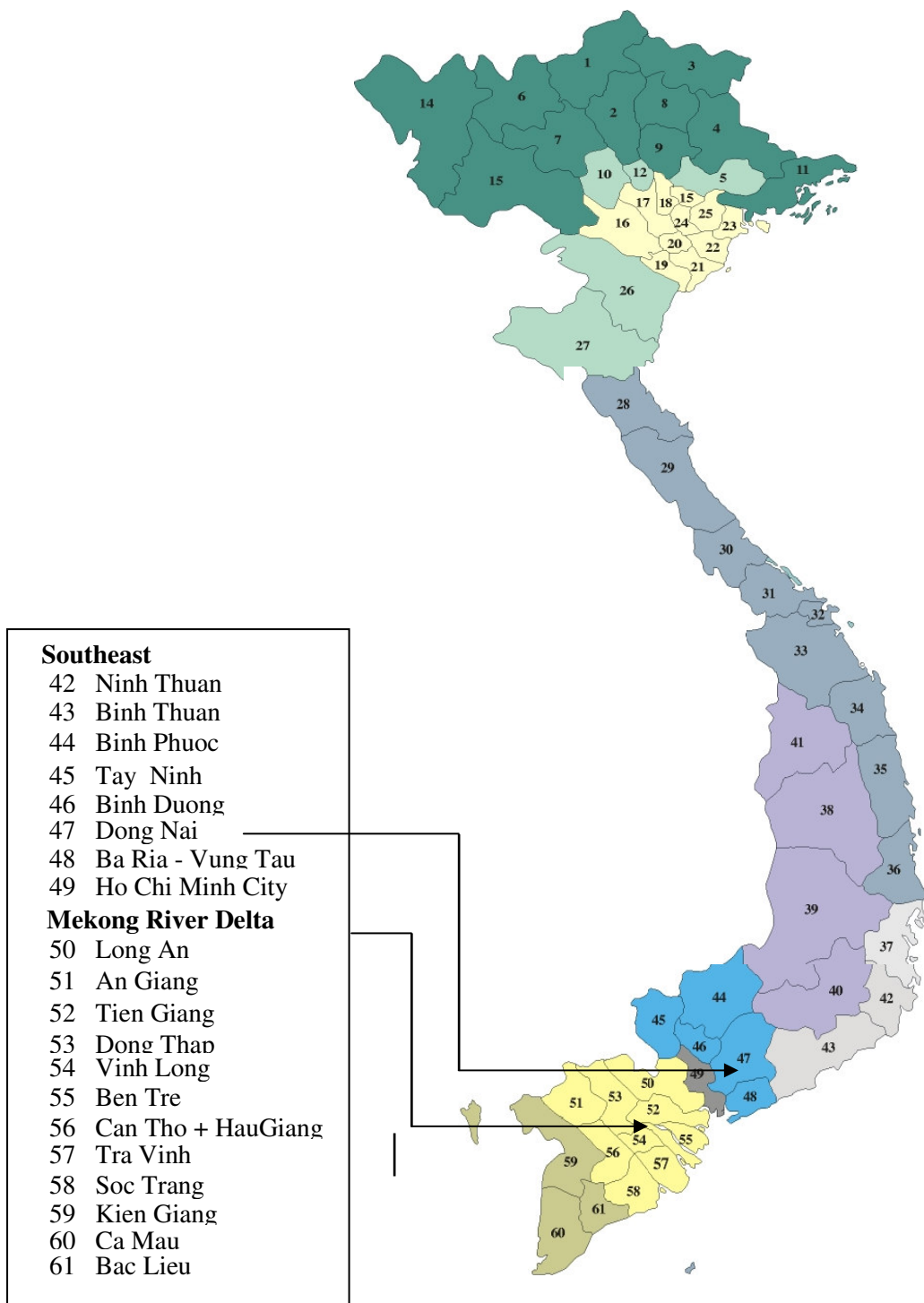  59   Kien Giang
  60   Ca Mau
  61   Bac Lieu

Chart 1. Location map of the region and provinces of the study sites in Viet Nam

# 7. RESULTS

## 7.1. Overview of Vietnamese swine industry

**General characteristics of Vietnamese swine industry**

The Vietnamese swine industry supplies meat, not only in Vietnam, but also in many other countries around the world. Advantages of raising swine include the short feeding time, quick growing and short production cycle. On average, one sow will reproduce twice annually, each time delivering between 8 and 12 piglets. These piglets can grow from 800 to 1,000kg in case of local varieties and up to 2,000kg in the case of foreign swine varieties (Hang 2005). The production levels of swine husbandry is 5 to 7 times higher than cow husbandry in the same feeding conditions. The proportion of meat per weight is reasonably high at 70 to 72%. In addition, swine consume less food by weight ratio and feed can be gathered from many sources such as waste food in farming households as well as food from the processing industry. Consequently, it is easy to breed swine in farming households.

Swine husbandry not only supplies food for local consumption, but also exports to foreign markets. For example, piglet products are high value exports to foreign markets such as Russia, Hong Kong, China, Japan, Singapore and Korea. In some rural areas of Vietnam, swine husbandry supplies raw material like swine manure to the fertilizer industry to enrich land.

**The development process of the Vietnamese swine industry**

The Vietnamese swine industry developed early in rural areas. In the past, due to unstable food sources, swine was almost always fed the waste food of households. Swine bred during this period were usually local varieties because of local varieties were easier to feed and required a lower level of investment capital.

In more recent years, swine husbandry has changed from the scatter method to the concentration method. Swine varieties are hybrid and foreign swine varieties with characteristics such as short feeding time and high food consumption.

**Situation of swine production in the Mekong River Delta**

In recent years, there has been an improvement in the economy of the MD. In 2004, the GDP was 10.6% and the average income per capita was VND 484,000, an increase of 36% as compared to 2002. In the swine sector, in 2005, the number of swine in the MD is predicted to be 3.4 million and the quantity of pork planned is 357,000 tons. Until 2010, the number of swine in the MD was predicted to be 4 million and the quantity of pork per year was estimated at 470,000 tons (Hang 2005). In general, the MD has good weather and natural conditions and consequently should be able to develop to reach the above targets.

**Table 4:   Number of swine by province in the MD from 2000-2004**
**Unit: thousand heads**

| Area/Province | Year | | | | |
|---|---|---|---|---|---|
| | **2000** | **2001** | **2002** | **2003** | **2004** |
| Whole country | 20,193.8 | 21,800.1 | 23,169.5 | 24,884.6 | 26,143.7 |
| MD | 2,976.6 | 2,946.1 | 3,151,6 | 3,448.6 | 3,713.8 |
| LongAn | 187.1 | 212.1 | 213.7 | 241.1 | 280.2 |
| DongThap | 186.5 | 214.3 | 227.4 | 272.2 | 304.0 |
| AnGiang | 186.1 | 164.9 | 179.8 | 203.8 | 252.3 |
| TienGiang | 429.1 | 437.6 | 464.6 | 486.4 | 495.4 |
| VinhLong | 245.7 | 256.9 | 269.0 | 285.2 | 300.9 |
| BenTre | 280.8 | 272.6 | 288.5 | 312.1 | 315.4 |
| KienGiang | 277.0 | 265.2 | 296.7 | 331.0 | 358.2 |
| Cantho city | 242.6 | 289.2 | 288.0 | 314.5 | 149.3 |
| HauGiang | | | | | 181.0 |
| TraVinh | 225.2 | 232.0 | 282.5 | 307.8 | 349.6 |
| SocTrang | 224.7 | 226.4 | 236.3 | 256.1 | 273.8 |
| BacLieu | 206.0 | 187.1 | 203.3 | 222.3 | 226.4 |
| CaMau | 285.8 | 187.8 | 201.8 | 216.1 | 227.3 |

*Source: Statistics yearbook 2004*

The number of swine in the MD has continuously increased in years.. By 2004, swine had increased 26% as compared to 2001 (from 2,946 thousand heads in 2001 to 3,713 thousand heads in 2004). Among the provinces in the MD, TienGiang province had the largest swine production (495.4 thousand heads in 2004)

*Advantages of Raising Swine in the MD:*
- Central and local governments are interested in developing swine production and consumption.
- Natural conditions are suitable for the development of the swine breeding industry
- Breeding feed is available in multiform.
- Veterinary networks are available at villages and have an ability to treat deadly diseases.

- Numerous researchers are available in the MD provinces, particularly in CanTho University.
- Trading conditions are favorable.

*Disadvantages of Raising Swine in the MD:*
- Local piglets have poor productivity and low meat quality
- Animal protein feed is insufficient
- Fluctuations in domestic and foreign markets in terms of price and demand
- Professional skills in swine breeding are low
- Little improvement in pork processing
- Threats of epidemics in swine production

## 7.2. Market structure in the swine marketing channels

**Intermediaries involved in swine marketing system**

### a. Swine breeders/Raisers / producers

Raisers include farmers who are involved in raising swine (sow, piglet, and swine). In case of raising sow, farmers raise sow both to increase the number of piglets as well as for sale to neighbors, collectors and traders (13 kg per piglet). The current price of a piglet is high enough for farmers to earn profit. In the MD, most swine raisers are non-centralized producers raising an average of 15 heads, 2-3 times per year.

Most breeders raise swine in small and simple pigpens which are suitable given the economic condition of households. The waste of swine is not processed, instead it is collected and put in the garden or poured into ponds. Centralized producers, however, use biogas systems to process the waste of swine.

Nowadays, most swine breeders use industrial cattle-feed to raise swine. They mix industrial cattle-feed with by-products from agricultural production such as bran and broken rice as well as by-products from processing noodles and the waste food of restaurants and households. This traditional raising technique helps swine breeders to reduce feeding costs and increase profit.

According to survey results, half of swine breeders entered the swine industry after the year 2000. The average age of breeders is over 40 years old. Most of which are small scale swine producers. In breeders opinions, raising sow is more efficient than raising porkers, as breeders can sell piglets and earn more profit.

**Figure 3:    Inflow and outflow operation of swine breeders**
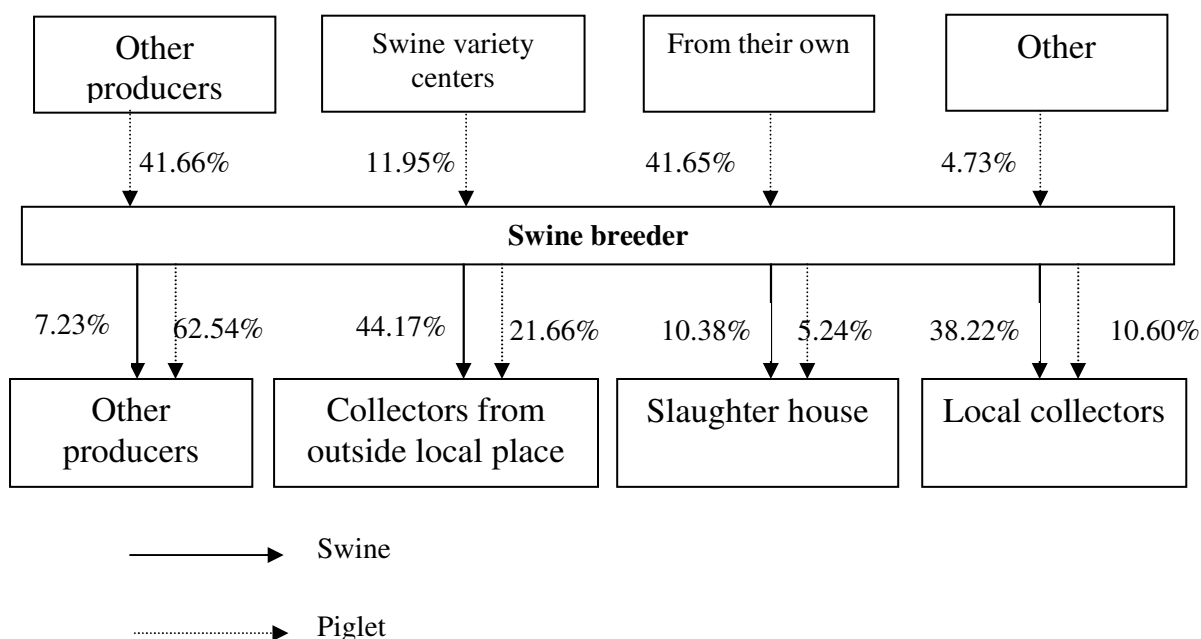


*Source: survey (2005)*

*Inflow operation*

Swine breeders buy piglets from other producers (generally neighbors) and state companies such as Swine Variety Center. 48.35% of piglets are sourced from other producers and 51.65% are homegrown.

*Outflow operation*

Swine breeders sell 62.54% of piglets to other producers and 21.66% piglets to collectors. The remaining piglets are sold to local collectors and slaughter-houses. Collectors from outside the local region make up 44.17% of collectors where as 38.22% are local. Breeders sell swine to these actors for two main reasons: (1) because of the good relationship between actors and breeders (2) these buyers pay cash and offer a reasonable price. The consumption swine for other purposes such as wedding parties, worship, etc. is 7.23%. The remaining piglets are sold to slaughter-houses.

**b.    Collectors**

Collectors enter the swine industry as it does not require a high education level or capital investment or alternatively it is the traditional career of previous family members. Most collectors are involved in small enterprises and do not own stocking ground or selling facilities. However, they do normally own transportation facilities or rent boats to transport swine or piglets from farm gate to the purchasing points. We distinguish three levels of investment capital for collectors: less than 10 million VND; from 10-20 million VND and more than

20 million VND. Part of this investment capital is used to buy boats and motorcycles as the main means of transportation for the business.

**Table 5:     Transportation means of collectors**

| Means | % |
|---|---|
| - Motorcycle | 60.00 |
| - Boat | 33.33 |
| - Motorcycle and boat | 6.67 |

*Source: survey (2005)*

There are three kinds of collectors (1) collectors who buy swine from breeders then slaughter and sell pork to retailers. (2) Collectors who buy swine from breeders then re-sell to retailers. (3) Collectors who buy swine from breeders then re-sell to other collectors from other places/provinces. The number of swine collected will depend on the time of the year and market demand. The average number of swine collected is 5 heads per day. In most cases, collectors use family labor. They may also hire additional labor, particularly during the Tet holiday season.

*Inflow operation of collectors*
The activities of collectors are described in figure 4, which indicates that 35.37% of swine are bought directly from breeders living in the same district, and 23.32% from breeders living in the same commune. In addition to buying directly from producers, collectors may also buy swine from producers outside of the province (10.37%).

**Figure 4:     Inflow and outflow operation of collectors**

| Swine breeder in | | | | Collector | |
|---|---|---|---|---|---|
| Same commune | Same district | Same province | Different province | Local collector | Distance collector |
| 23.32% | 35.37% | 19.90% | 10.37% | 5.47% | 5.37% |

**Collectors**

| Slaughter-house | Retailer | Wholesaler | Distance collector |
|---|---|---|---|
| 0.29% | 21.82% | 15.05% | 62.84% |

*Source: survey (2005)*

140
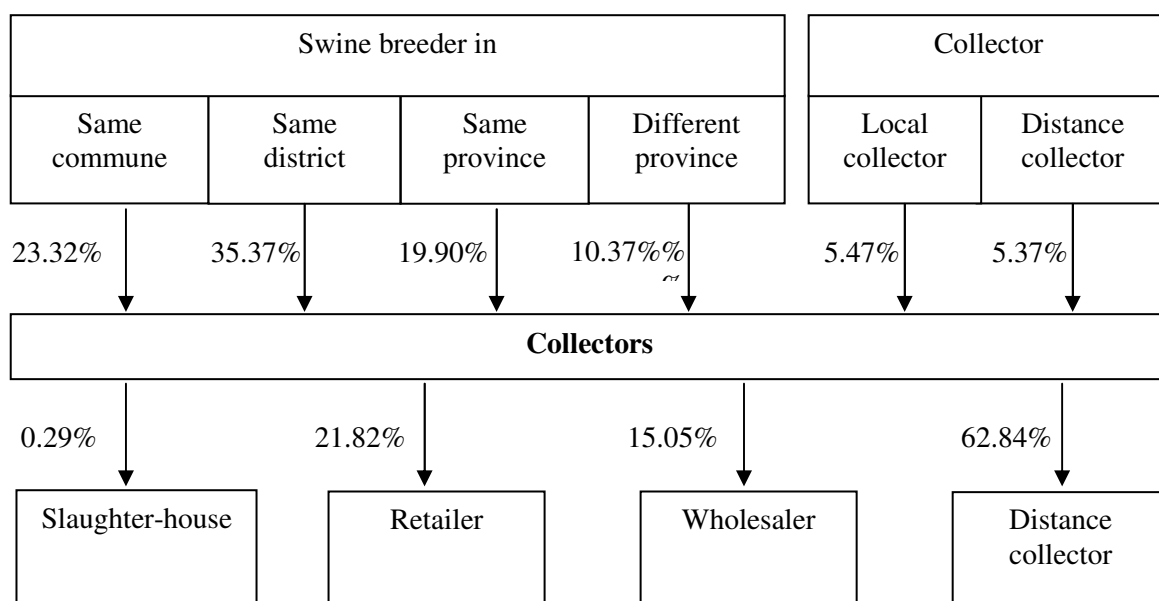
*Outflow operation of collectors*

After collectors have bought swine they will: (1) slaughter swine then sell pork to retailer (accounting for 36.87%), (2) re-sell swine to slaughter-houses (3) re-sell swine to distance collectors (occupying 62.84%).

### c. Slaughter house

The main activity of a slaughter house is slaughtering swine before delivering them to the consumer market. Thus, a slaughter-house participates in the swine distribution channel as a slaughtering service. There are two kinds of slaughter-houses: small scale slaughter houses and centralized slaughter-houses. In small scale slaughter-houses, the owners are also collectors. They buy swine from breeders or collectors then slaughter and sell pork to retailers. Thus, they must have sufficient space to keep the swine. The slaughter house will pay a fee to a local Veterinary Agency to check the quality of the swine (8,000VND/head). In some cases, slaughter-houses will also operate as wholesalers and distribute pork to other key players in marketing channel such as retailers, restaurants, eating houses and final consumers. The survey results indicated that most slaughter-house managers are men. For centralized slaughter-houses, the slaughtering scale depends on the level of investment capital of the owner or local government. Slaughtering services charge a slaughtering fee of 10,500 VND and also check the quality of swine. The main customers are retailers, collectors and others (household, restaurant, etc.).

### d. Traders (wholesalers, retailers)

Wholesalers: purchase a large amount of products from farmers or collectors and then sell to retailers.

Retailers: purchase a small amount of products from wholesalers and sell directly to final or industrial consumers, who usually own restaurants or meal shops.

Shopping is the main function of Vietnamese women. Thus, most retailers are women (more than 85%). They usually buy pork from slaughter-houses, collectors and/or wholesalers. As previously mentioned, most retailers play a role as collectors, purchasing and slaughtering swine in slaughter houses then selling the pork on the market. The majority of customers who purchase from retailers are final consumers (accounting for 84.31%). The second largest consumer group is restaurants, eating houses and processors (accounting 12.24%).
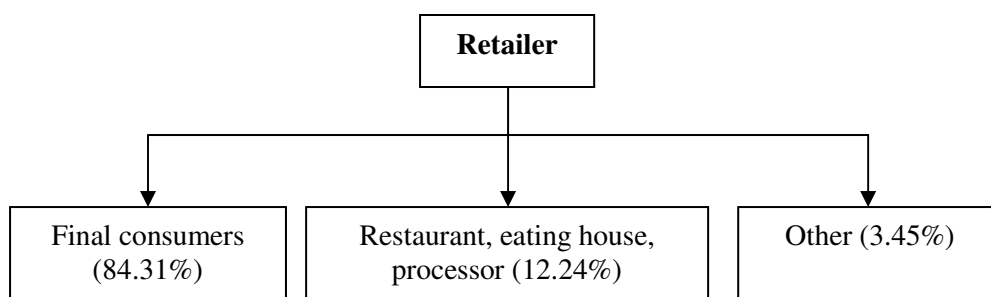
```
                    ┌─────────────┐
                    │  Retailer   │
                    └──────┬──────┘
          ┌────────────────┼────────────────┐
          ▼                ▼                 ▼
┌──────────────────┐ ┌──────────────────┐ ┌──────────────────┐
│ Final consumers  │ │ Restaurant,      │ │ Other (3.45%)    │
│ (84.31%)         │ │ eating house,    │ │                  │
│                  │ │ processor        │ │                  │
│                  │ │ (12.24%)         │ │                  │
└──────────────────┘ └──────────────────┘ └──────────────────┘
```

**Figure 5:    Outflow operation of retailers**
*Source: survey (2005)*

The majority of consumers live in the same hamlet, commune or district within the province. Of which, the ratio of consumers living in same location is the highest.

### e.    Processors

Processors who own transport facilities and mainly buy swine from collectors both within and outside the province also bought from swine breeders. Some processors also function as a slaughter-house. After processing, processors deliver processed products to supermarkets, eating houses and retailers.

*Inflow operation*

In the production process, processors either buy pork from slaughter houses/retailers (73%), or buy semi-completed products which were only processed partly (27%). Most processors pay by cash when buying products from sellers, the remaining will purchase on credit, paying some days later.

*Outflow operation*

Processed products include grilled chopped meat, pate, etc. These products are sold to final consumers, retailers, wholesalers and supermarkets both within and outside the province. The form of payment between processors and buyers is mainly cash or credit.

### Competition in the Mekong Delta swine market

### a.    The existence of entry and exit barriers
### Control of essential resources

Survey results indicate that the techniques used for raising swine are not particularly difficult. There are many sources of support for raising swine such as television, radio, books, and magazines, etc. Breeders also learn from neighbors, breeding engineers or simply learn themselves.

142

According to the statistical yearbook, the average number of household members in the countryside is 6 persons. This is compared with breeder households where the average members of household is 5.5 persons. The survey indicated that most households do not face many difficulties in obtaining labor (lack of labor force was ranked at 7, where 1 indicates the highest level of difficulty). Thus, it can be concluded that there is sufficient labor for new entrants into the swine market. In short, raising techniques and the labor force do not create barriers for new breeders to enter the swine breeding industry.

**Capital requirement**

Thousands of swine breeders in the MD are small scale producers. They raise an average of 10 heads, 2-3 times per year. Approximately 58% of swine breeders feed swine waste food or agricultural by-products in order to increase income. Typically, new breeders will start with two or three piglets. Consequently, they do not need a large financial outlay to begin investing in swine. Initially, money is only spent on piglets, raising swine facilities and feeding costs. During breeding, swine may be feed using waste food and agricultural by-products. Subsequently, capital requirements are not a barrier to entrance in the swine industry.

**Marketing advantages of incumbency**

There are thousands of swine collectors in the MD. Consequently, swine breeders do not need to be concerned about finding buyers. A more important consideration is fluctuations in market price. If the market price of swine increases, breeders will start to raise more swine than usual, consequently there is surplus supply and market price of swine decreases. Breeders will then reduce the number of swine being raised until there is a shortage in supply and market price increases again. Fluctuation in market price was ranked the greatest difficulty faced by swine breeders in relation to expanding swine production scale (see table 6). Fluctuations in market price are also influenced by factors such as bird flu, disease, etc. In order to stabilize profit, breeders usually sell swine to familiar collectors. In the case of surplus supply, there are some collectors who will buy swine from new swine breeders at a low price. As a result, market information is crucial for swine breeders, as it is useful in the decision of whether to raise swine and at what level.

In short, from the above analysis we can conclude that the market environment for raising swine is a competitive market. The existence of entry barriers in the swine raising industry is low as: (1) households can easily raise swine with their available labor force; (2) a low level of capital investment capital is required; (3) techniques for raising swine are not difficult; (4) marketing advantages.

Despite this, during the production process and expansion of production scale, swine breeders still face difficulties (as shown in table 6).

**Table 6:  Difficult issues in raising and expanding swine production scale**

| ISSUES | RANK | Percentage |
|---|---|---|
| - Fluctuation of market price | 1 | 25.4 |
| - Lack of capital | 2 | 23.6 |
| - Swine disease | 3 | 19.2 |
| - Lack of raising technique | 4 | 13.5 |
| - Lack of market information | 5 | 4.3 |
| - Few of buyers | 6 | 3.8 |
| - Lack of labor force | 7 | 2.4 |

*Source: survey (2005)*

If production scale is expanded, the knowledge of raising techniques and market information needs to increase such that breeders can raise and sell their swine appropriately.

For traders, the existence of entry and exit barriers is also low. Retailers are only required to have a small amount of capital including a small shop for selling pork. Thus, they can easily cease business in the face of trouble or loss.

The second largest amount of risk is borne by the retailer (the most risk is borne by the swine breeder). Retailers face risk because there are is large amount of substitute products available on the market such as fish, eggs, etc. The price of these substitute products can be very competitive. In addition, if retailers can not sell all products within one day, the products will be lost as they can not be stored and sold in following days (see table 7 for difficulties faced by traders).

**Table 7:  Difficult issues in traders' activities**

| Factors | Rank | Percentage |
|---|---|---|
| - Fluctuation of market price | 1 | 28.3 |
| - High tax rate | 2 | 19.4 |
| - Lack of capital | 3 | 16.9 |
| - High competition | 4 | 14.5 |
| - Business license | 5 | 11.2 |
| - Lack of information | 6 | 8.8 |

*Source: survey (2005)*

In previous years, traders did not need a business license and there was no tax payment required. However, from 2005 high tax rates effected the profit and competition among traders increased. As consumer prices increase and the value of money goes down, the value of trader's capital decreases.

**b.    The assortment of product quality**

The selling price of swine differs based on variety. In general, there are three kinds of swine variety in the MD: (1) local swine; (2) hybrid swine and (3) 100% foreign swine. Over 50% of swine breeders use foreign swine varieties such as Yorshir Large White, Landrace, Duroc, etc. which have advantages of high productivity, high value and quick growth (180-270 kg per sow, 280-350 kg per boar, 100-130 kg per porker). Swine breeders clarify foreign swine varieties are porker class 1. Table 8 will show the clarifications of swine as sold to the market.

**Table 8:      The clarification of swine      Unit: kg**

| Clarification | Weight for selling |
|---|---|
| Piglet | 12 – 15 |
| Swine | 30 – 40 |
| Porker class  3 | 80 – 90 |
| Porker class  2 | 91 – 99 |
| Porker class 1 | 100 –125 |

*Source: survey (2005)*

Breeders prefer to raise porkers over piglets as the price of a porker is more attractive. Porker class 2 is the easiest to sell as porker class 2 comprises lean meat which collectors prefer. For collectors, swine price depends heavily on weight, variety and health. The price difference between porker class 1, class 2 and class 3 is VND500 per kg.

Slaughtered swine is used for many products based on type whether it be pork, born, liver, swine's triples, etc. The quality of pork is based on the color of meat, the amount of fat and whether it is free of disease.

In short, the swine differentiation is not high. Swine products are rather homogenous.


**c.    The distribution of market information**

The distribution of market information refers to the availability of relevant market information. Table 9 shows the awareness of market price of each actor in the distribution channel. Around 80% of actors can easily access market information. Few actors have difficultly in accessing market information. Thus, lack of access to market information is not a barrier to entrance as most information related to swine trading such as quality signals, form of delivery and payment, buying-selling prices, consumer behavior, regulation, etc. can be easily obtained.

**Table 9:  Access to market information of each actor in the distribution channels**

| ACTORS | Percentage of response to different levels (%) | | |
|---|---|---|---|
| | Easy to obtain | Sometimes difficult | Very difficult |
| Breeder | 80.5 | 18.1 | 1.6 |
| Collector | 86.4 | 12.5 | 1.1 |
| Slaughter house | 78.9 | 19.6 | 1.5 |
| Retailer | 82.7 | 17.3 | 0.0 |

**Table 10:  Sources of market information**

| *Sources of information* | **Percentage of response to different sources (%)** | | |
|---|---|---|---|
| | **Breeder** | **Collector** | **Retailer** |
| - From media sources (newspaper, radio, TV) | 34.85 | 29.41 | 33.33 |
| - From family, relative, other producers | 30.30 | 11.76 | 13.33 |
| - From middlemen in marketing channels | 25.38 | 29.41 | 53.34 |
| - Others: | 9.47 | 29.41 | 0.00 |
| Total | 100.00 | 100.00 | 100.00 |

*Source: survey (2005)*

There are three main sources of market information that breeders, collectors and retailers can get and were showed detail table 10.

**The process of swine price formation**

In general, price is based on market power, bargaining skills, quality of product, volumes of sales per transaction and sales location.

**Table 11:  Output – price – formation**

| Price formation | Percentage of response by different actors | |
|---|---|---|
| | Collector | Retailer |
| 1. Buyer | 2.94 | 3.57 |
| 2. Supplier | 41.18 | 39.29 |
| 3. Negotiation between buyer and supplier | 55.88 | 57.14 |
| Total | 100.0 | 100.0 |

*Source: survey (2005)*

146

Table 11 shows the responses of different actors when asked "Who is setting the price?" The figures indicate that over 55% is negotiation between buyers and suppliers. Buyers do not have much market power when determining price. On the other hand, suppliers have power when setting price ( in around 40% of cases).

Normally collectors will offer a buying price then swine breeders will negotiate with collectors in relation to price and selling requirements. In some cases, collectors will offer a price and breeders will only sell the swine if they accept that price. Similarly, the price at which collectors re-sell to other collectors and slaughter houses is based on negotiation between buyers and sellers (55%).

The risk faced by collectors is less as they are middlemen. They simply buy and sell swine within one or two days due to feeding costs and the risk of swine losing weight, etc.

The process of bargaining in the swine market usually concerns negotiation on price per unit. As shown in table 11, the price per unit is fixed by some retailers (39%). Final consumers can bargain to get a good or reasonable price. However, the process of bargaining depends on swine breeders' prestige and the corresponding relationship with buyers.

**Table 12:  Some criteria affect to the process of setting price in 2005**

| Criteria | Rank |
|---|---|
| - Good swine variety, high productivity | 1 |
| - Weight or volume of sales per transaction | 2 |
| - Time (seasons) | 3 |
| - Payment by cash/credit | 4 |
| - Swine breeders' prestige | 5 |
| - Good relationship | 6 |

*Source: survey (2005)*

Table 12 shows that good swine variety and high productivity strongly effects the price setting process. For collectors, the quality of swine depends on swine variety, high productivity and whether the swine is free of disease. Collectors also pay attention to weight or volume of sales per transaction in the process of price setting.

Small scale production breeders usually raise less than 10 heads of swine. At harvest, they sell all of their swine together and collectors deliver within 5 days. When swine reach a suitable weight, breeders sell them as soon as possible.

This is because mature swine will gain more weight, getting too fat if breeders continue to feed them, resulting in impacts on income. Buyers will pay swine breeders directly using either cash or credit. If using credit they will normally pay after one or two weeks (table 13). Sales location will also directly effect price if transport costs are significant.

**Table 13:    The payment way of buyers to swine breeders in 2005**

| The payment way of buyers to swine breeders | Percentage | |
|---|---|---|
| | Porker | Piglet |
| - Pay advance buying swine from breeders | 5.83 | 1.49 |
| - Pay by cash | 7.77 | 16.44 |
| - Pay after one or two weeks | 86.41 | 82.07 |

*Source: survey (2005)*

Normally, swine breeders will call buyers if swine needs to be sold. In some cases, traders/slaughter houses will call swine breeders or visit their houses to negotiate and sign purchasing agreements (table 14).

**Table 14:    The communication way of swine breeders in 2005**

| The communication way of swine breeders | % |
|---|---|
| - Swine breeders call to buyers | 85.98 |
| - The buyers visit swine breeders | 13.08 |
| - Visit through raising schedule | 0.93 |
| Total | 100.00 |

*Source: survey (2005)*

**Collectors**

**Table 15:    The ways to collect selling information of collectors in 2005**

| The ways to collect selling information | % |
|---|---|
| - Get calls from breeders | 48.21 |
| - Connect with breeders | 25.00 |
| - Make advance arrangement with breeders | 10.71 |
| - Look for randomly | 7.14 |
| - Get information through other people | 5.36 |
| - Other | 3.57 |

*Source: survey (2005)*

148

Almost half of the activities of collectors involve waiting on a call from familiar breeders as the quality of swine from familiar breeders is more stable. However there are several methods used by collectors to obtain selling information from breeders (table 15).

**Table 16: Some other criteria to decide buying price of collectors in 2005**

| Criteria | % |
|---|---|
| - The variety of swine | 54.72 |
| - The number of selling swine | 11.32 |
| - The distance | 9.43 |
| - Other: market demand | 24.53 |

*Source: survey (2005)*

Other criteria that effect to the price setting process of collectors are outlined in Table 16. Different varieties of swine yield different buying price. For example, the buying price of class one swine is higher than the buying price of class two swine (50,000 VND/100kg) and the buying price of class two swine is higher the buying price of class three swine (50,000 VND/100kg). Consequently, swine variety is one of the most important criteria in determine buying price.

**Retailers**
Most retailers buy pork from slaughter-houses. However, some retailers play a role as the collector and buy swine from breeders to bring to slaughter-houses. In some cases, retailers have their slaughter-houses and do not buy pork from other sellers. The price setting in this case depends on negotiation between the slaughter-houses and retailers. The buying price of retailers depends on the proportion of meat in the swine, weight, swine variety, time, etc.

**Government policy, regulations and informal trade in the swine market**

**a. The role of the government in swine market**
The government has a role to play in encouraging the development of the swine industry as the average contribution to GDP in the industry is 7-8% per year.
In recent years, the Agricultural Departments of the provinces have improved in terms of controlling and managing animal husbandry. Particularly in the swine industry. These Departments manage the organization system from the lowest to the highest level. Every year, provincial Veterinary Agencies and districts conduct statistical analysis of swine populations in each household, training farmers with new techniques and management practices for raising boar. This is a program for improving productivity and quality in swine production.
The Extension Agriculture Department network supplies information to each level of the organizational system. This includes information such as the right

type of animal to breed within each region. These departments have also introduced techniques for managing and raising swine, including the effective prevention and control of epidemics. In 2004, the Extension Agriculture Departments extended agricultural systems from central government to local government in order improve the knowledge and skills of staff, particularly local extension staff. Currently, there are more than 22,000 extension staff in Viet Nam with 520 districts possessing extension agriculture departments and more than 7,140 communes utilizing extension staff. In the future, the Ministry of Agriculture and Rural Development and the Vietnamese Extension Agriculture Center will cooperate to attract foreign investment – such as projects from ADB and WB – in order to strengthen agricultural activities.

## b. Major policy and regulation changes in the promotion of swine trading

**Breeding and Quality control policies**

The government has promoted the development of high-level exotic bloodlines and crossbred animals for dispersal within the breeding system. Ideally, a pyramid breeding system should be used to disseminate high quality animals into the general livestock population.

- Decision 14-CP (March 19, 1996) on the management of domestic animals.
- Decision 68/1998/QD-TTG (March 27, 1998) allowing the experimental establishment of state enterprises in training as well as research institutions.
- Decision 225/1999/QD-TTG (December 10, 1999) approving a program of plant seeds, livestock breeds and forest tree seeds in the 2000-2005 period.
- Decision 166/2001/QD-TTG (October 26, 2001) on a number of measures and policies to develop swine farming for export in 2001-2010.
- Session two-chapter one of Decision No 34/2001/QĐ-BNN/VP (March 30, 2001) - Minister of Agriculture and Rural Development about "Conditions for doing business on planting, breeding variety and cattle-feed"

Currently, there are more than 27 research institutions and 11 centers for variety production. In the MD, there are a few private enterprises that satisfy the conditions to operate a "breeding variety" business. These research institutions and centers are unable to meet the high level of production demand for varieties, which is due to high competition in local and foreign markets. In fact, only 30% of market demand is being satisfied. As a result, there has been much fluctuation in variety price.

According to session two of chapter two of Decision No 34/2001/QĐ-BNN/VP on March 30, 2001 from the Minister of Agriculture and Rural Development

regarding "Conditions for doing business on slaughtering service", slaughter-houses must satisfy certain conditions under the management of the Veterinary Division. After this decision was issued, the number of swine increased rapidly as farming households in rural areas had more choice in choosing swine varieties as well as an increased number of slaughter houses.

The decision on July 1, 2004 regarding "Breeding variety" focuses on improving administrative jobs and does not add any management divisions into the system such that the administrative system remains simple. It suggests that people should be encouraged to discover new breeding varieties with high quality, productivity and economic efficiency. Particularly it discusses encouraging farmers to do their own research.

## Feeding policy

Commercial feed production has increased substantially since 1988. The share of commercial feed consumption in total grain based animal feed consumption has grown from less than 1 percent to approximately 27 percent (MARD, 2002). As commercial feed quality, supply and demand increase and prices slowly fall, the industry is affected by a number of problems which constrain the development of an efficient feed industry and affect the adoption of commercial feed by producers (Nam, 2003). Animal feed policies were established that aimed to develop both agricultural and industrial feed for swine, livestock and animal industries. For example, Decision 166/2001/QD-TTG (October 26, 2001) on a number of measures and policies to develop swine farming for export in the 2001-2010 period.

Until now, there has been Decree No 15 of government on March 19, 1996 about "Managing animal feeds, and Circular 08/1996, guiding the implementation of decree 15-CP". However, there is still a large amount of low-quality cattle-feed imported unofficially. Often the brand name quality differs from the actually quality of the feed. This affects not only the quality of swine, but also cost as feed occupies a large proportion of production costs.

## Animal health and veterinary services policies

Current policies for animal health and veterinary services are numerous and varied. However, there are five major animal health and veterinary services policies in the livestock sector established by the central government.

- Decree 93/1993 on implementing the sub-law of 1993, and addressing procedures and regulations on animal health.
- Directive 403-TTG (July 11, 1995) on improving the supervision of animal slaughter and the control of veterinary hygiene for animal based foods.
- Decision 08/1999/QD-BN-TCCB (January 12, 1999) on the organizational system of border-gate animal quarantine stations.

- Circular 53/2001/TT-BTC (July 3, 2001) guiding the regime on the collection, remittance, management of the use of charges and fees in the veterinary service.

**Extension and agricultural research policies in the livestock sector**
In general, there are three main articles of legislation covering the livestock sector pertaining to research and extension services.
- Decision 14-CP (March 19, 1996) on the management of domestic animals.
- Decision 68/1998/QD-TTG (March 27, 1998) allowing the experimental establishment of state enterprises in training as well as research institutions.
- Decision 166/2001/QD-TTG (October 26, 2001) on numbers of measures and policies to develop swine farming for export in the 2001-2010.

**Commercialization policies in the livestock sector**
Swine, as a type of livestock production, offers the opportunity to capture higher value added per hectare as compared with crop-based agriculture. Swine production plays an important role in providing a large share of cash income to farming households, which in turn has a strong multiplier effect on local communities. Thus, commercialization policies were enacted to promote and enhance market function in the livestock sector.
- Directive 22/2000/CT-TTG (October 27, 2000) on the strategy of developing the export and import of commodities and services in the 2001-2010 period.
- Decision 02/2001/QD-TTG (January 2, 2001) on policies of investment support from the development assistance fund for export production as well as processing projects and agricultural production projects.
- Decision 46/2001/QD-TTG (April 4, 2001) on management of export and import goods in the 2001-2005 period, and Circular 62/2001/TT-BNN (5 June 2001) guiding the export and import of goods subject to specialized management from the agriculture service.
- Decision 65/2001/QD-BCT (June 29, 2001) on rewards based on export turnover of rice, coffee, pork and canned vegetables and fruits in 2001.
- Decision 166/2001/QD-TTG (October 26, 2001) on a number of measures and policies to develop swine farming for export during 2001-2010.

**Marketing and distribution policies in the livestock sector**
Vietnam has shifted to an open market economy that operates under a competitive mechanism. However, the marketing system and distribution have faced issues that have limited market function. Decision 166/2001/QD-TTG

(October 26, 2001) "A number of measures and policies to develop swine farming for export in the 2001-2010 period" is a main policy established to stimulate the livestock market's functioning.

**Financial Institution**
The importance of financing has been proven not only for swine production, but also for other commodities and industries. There are several institutions or programs that help by providing finance to small and medium scale enterprises. The Agriculture and Rural Development Bank is the primary financing institution that engages in agriculture and lends to farmers with reasonable interest rate without distinguishing a level of breeding. The Agriculture and Rural Development Bank system has agencies in cities, districts, villages and hamlets and is the strongest financing institution in agriculture. However, in recent year the process of delivering money to farmers has been slow due to required forms, credit procedures and fixed amounts of money for lending.

**Conclusion on analysis of market structure**
This chapter described the framework which the swine actors operate within. Different types of market intermediaries are illustrated and the existence of marketing channels is presented. Based on the elements of market structure, we can conclude that the swine markets examined are competitive. With regard to competition: (1) barriers to entry and exit are low; (2) product differentiation is not a major issue in the market; (3) information is accessible for actors in channels and the main sources of information are public media and other middlemen; (4) the formation of price does not depend strongly on suppliers or buyers but rather the negotiation between buyers and suppliers.
We can also conclude that the formal rules and regulations of the government are important to the swine market. Changes in regulations and policies have promoted swine trading. In short, all elements of market structure have a good function; there is no room for individual behavior in the swine market.

**7.3    The effectiveness of swine marketing channels**
The swine marketing channel performs three main functions. These include exchange functions (ordering, assembling, negotiation, market information, payment and distribution); physical functions (storage, processing, transport); and facilitating functions (grading, financing).
Collectors buy swine from swine breeders and transport it to the slaughter house (usually 1 to 13 heads). On average, traders sell 350kg of slaughtering swine per day. Swine are classified during the purchasing process. However, after slaughter swine products are classified based on the proportion of meat and fat. Retailers sell slaughtering swine in the wet markets by grading it under classifications such as pork, liver, fat, stomach, etc. They sell more than 100kg

per day to final consumers, restaurants, eating house and etc. Retailers will try to sell swine within a day as slaughtered swine can not be stored.

In the swine marketing channel, there is a lack of market information as actors can not access market information at the right time. It means that actors can access market information as previously mentioned but the information is not always up-to-date or reliable. Actors in swine marketing channel may also face difficulties in gaining finance and thus may lack money for businesses expansion.

Non-centralized slaughter houses keep non-slaughtering swine in the pigsty. On average these swine will lose 3% of their weight nightly. 57.7% of non-centralized slaughter houses will store swine for less than 2 days and 36.3% will store swine from 2-4 days(table 17).

**Table 17: The keeping time of non slaughtering swine**

| Time | Percentage (%) |
|---|---|
| - Less than 2 days | 57.5 |
| - From 2-4 days | 36.3 |
| - More than 4 days | 6.2 |
| Total | 100.0 |

*Source: survey 2005.*

For retailers, most of the input comes from slaughter houses. Half of retailers contact and buy slaughtering swine directly from slaughter house. Therefore, the retailer also plays an important role as a collector, buying and slaughtering swine. Due to specialized characteristics, retailers would not make orders in advance as they are unsure on the final demand for their product.

**Table 18: The payment way of the buyer**

| Customers | Pay by cash | Pay by credit |
|---|---|---|
| 1. Final consumer | 84.70 | 15.30 |
| 2. Eating house, restaurant | 21.30 | 78.70 |

*Source: survey 2005*

A large proportion of slaughtering swine sold by retailers was sold by credit to eating houses and restaurants (see Table 18). This issue creates difficulties such as the slow collection of money and debt. Consequently, there is a lack of capital for the business expansion of retailers and the level of risk face in increased due to an inability to collect debt from customers. In order to reduce risk, retailers usually only sell by credit to prestigious customers (account 44.55%). Sellers will determine the payment time as well as a percentage of sales that will be able to use credit.

The swine marketing channel has evolved as end-users (both business-to-business buyers and individual consumers) usually prefer to deal with a marketing channel as it provides higher service outputs such as bulk breaking, spatial convenience, waiting and delivery time, product variety.

**Bulk breaking:** the actors in the swine marketing channel can buy products with different sizes and weights. For example, end-users can buy swine product with the desired (possibly small) number of units of pork, liver, etc. even though the original product is produced in large, lot sizes. The most popular consumption product is pork (45%) and then borne (17%).

**The spatial convenience factor of the service output**: the actors in the swine marketing channel use several kinds of transportation such as boats, motorcycles, vans, etc. Wholesale and retail shops choose locations where they can sell directly to consumers; which are convenient for transportation, loading and un-loading the product (space for parking, near the main roads or canals); and are at a central place that attracts customers. Approximately 60% of collectors use motorcycles or vans to transport swine where as only one-third use a boat as their main transportation.

**Waiting and delivery time**: the end-user does not need to wait when purchasing swine products as they can easily purchase directly from retailers. Slaughter houses operate from 1:00AM – 3:00AM and from 2:00PM – 3:00PM beneficial time schedules for customers. In most cases (80%), transactions between actors are in cash. The remaining payments are in advance or over several payments.

## 7.4   Value-created in the swine distribution channels

*Analysis of marketing cost and margins*

**Farmer (Swine breeders)**
The production costs of swine breeders include purchase of  the swine variety, feeding, veterinary, labor costs and other costs. As most swine breeders use their own capital, interest rates are not included as a production cost.

**Table 19:    Swine production cost**

| Costs | Amount (VND/Kg) | Percentage (%) |
|---|---|---|
| - Feeding (purchase) | 6,522.17 | 49.5 |
| - Swine variety | 4,731.42 | 35.9 |
| - Family labor | 1,049.39 | 8.0 |
| - Feeding (own) | 419.16 | 3.2 |
| - Electricity, water | 172.18 | 1.3 |
| - Veterinary | 145.45 | 1.1 |
| - Pigpen | 133.90 | 1.0 |
| - Other | 14.31 | 0.1 |
| **Total cost** | **13,187.98** | **100.0** |
| Selling price | 17,192.39 | |
| **Profit** | **4,004.41** | |

*Source: survey (2005)*

Of all the production costs, feeding costs are the most substantial. Consequently, a major reason for increased production costs is increased price of feed. The second most substantial cost is the swine variety cost which depends on the fluctuating harvesting swine price. Labor costs are generally a family cost as breeders do not generally hire extra labor. On average, swine breeders earned 4,004VND/Kg at harvesting swine (higher if the family labor cost is omitted). So if they raise 10 swine and the average weight at harvesting time are 100kg per head. They will earn 4,004,000 VND.

**Collectors**

The cost of collectors mainly comprises labor and transportation costs. However, if collectors buy and slaughter swine themselves, the cost increases. Table 20 details the marketing costs of collectors.

**Table 20:  The marketing cost and profit margin of collectors**
**Unit: VND/kg**

| Items | Cost |
|---|---|
| - Labor cost | 282 |
| - Transportation cost (buying and selling) | 197 |
| - Quarantine fee | 102 |
| - Tax | 82 |
| - Electricity and water costs | 24 |
| - Others | 107 |
| **- Total cost** | **794** |
| - Buying price | 18,125 |
| - Selling price | 23,500 |
| - Marketing margin | 5,225 |
| - Profit margin | 4,431 |

*Source: survey (2005)*

If collectors buy and resell swine without slaughtering, they earn 40.000 – 50.000 VND/100kg. However, if they slaughter swine, they earn 70.000 – 100.000 VND/100kg.

**Slaughter house**

There is at least one or two slaughter houses in each commune or district. The size of the slaughter house depends on the size of the market. Costs borne by slaughter houses include electricity and water costs, fuel, labor cost, tax etc. For centralized slaughter-houses, a quarantine cost is paid (7,000VND/head) as well as a 10,000VND slaughtering fee. The costs for small-scale slaughter houses are given in Table 21.

**Table 21:    The cost of slaughter house**
**Unit: VND/kg**

| ITEMS | AMOUNT |
|---|---|
| **Total cost** | **92,65** |
| Chemical | 8,20 |
| Fuel | 26,16 |
| Electricity and water | 11,55 |
| Labor | 29,84 |
| Environment fee | 0,34 |
| Tax | 9,72 |
| Others | 6,84 |
| Earning | 108,96 |
| **Profit** | **16,31** |
| Profit/Total cost | 0,18 |
| Profit/Earning | 0,15 |

*Source: survey (2005)*

**Retailers**

The sale of swine products can be classified into two types: fresh meat and processed products. Fresh meat is sold by retailers in the wet markets or in supermarkets they sell lean meat, liver, swine bone, etc. As pork is easily damaged, sellers try to sell it within a day. If customers buy pork in bulk, they receive a discount of 500-1,000 VND/kg or are sold a higher quality pork. In some cases, retailers will deliver pork to customers' homes.

The consumption pork also depends very much on the day of the month or year. For example, in January, July and October of the Chinese calendar, the consumption of pork is low as many people choose not to eat pork at this time because of reasons of religion.

**Table 22:    The marketing cost of retailers**
          **Unit: VND/kg**

| Items | Amount |
|---|---|
| • Transportation cost | 302.86 |
| • Rent selling-buying ground fee | 211.60 |
| • Labor cost | 204.33 |
| • Tax | 66.51 |
| • Electricity and water fee | 13.69 |
| • Others | 175.80 |
| - Marketing cost | 974.79 |
| - Buying price | 25,000.00 |
| - Selling price | 27,800.00 |
| - Marketing margin | 2,800.00 |
| - Profit margin | 1,825.21 |

*Source: survey (2005)*

Transportation costs, rent buying-selling ground fees and labor costs are the most significant costs borne by retailers. The selling price of retailers is much higher than buying price. As a result, they earn more profit. However, they also need to exert more effort as pork needs to be sold within one day, preferably in the morning.

**Table 23:  Summary the marketing cost and profit margin of each actor in marketing channel**
          **Unit: VND/kg**

| Actors | Production/ buying price | Selling price | Marketing margin | Marketing cost | Profit margin |
|---|---|---|---|---|---|
| | (1) | (2) | (3)=(2)-(1) | (4) | (5)=(3)-(4) |
| - Breeder | 13,187.98 | 17,192.39 | 4,004.41 | | |
| - Collector | 18,125 | 23,350 | 5,225 | 794 | 4,431 |
| - Slaughter house | 92.65 | 108.6 | 16.31 | | |
| - Retailer | 25,000 | 27,800 | 2,800 | 974.79 | 1,825.21 |

*Source: survey (2005)*

Table 23 indicates that the marketing costs of collectors is the highest out of all actors in the swine marketing channel. However, they also have the highest profit margin as some collectors have their own slaughter-houses. The actors with the second highest profit margin is swine breeders. In recent months, the price of harvesting swine has increased rapidly as people consume more pork

and less poultry due to bird flu. Third come retailers, with low marketing costs, the profit margin of retailers is quite high. The lowest margin is the slaughter-house. Although the slaughter house's profit (VND/kg) is lower than other actors in distribution channel, overall they receive a high profit due to the large quantities of swine that are slaughtered each day.

*The division of value – created in the swine marketing channels*

**Figure 6:Division of value – created in the production of swine industry**
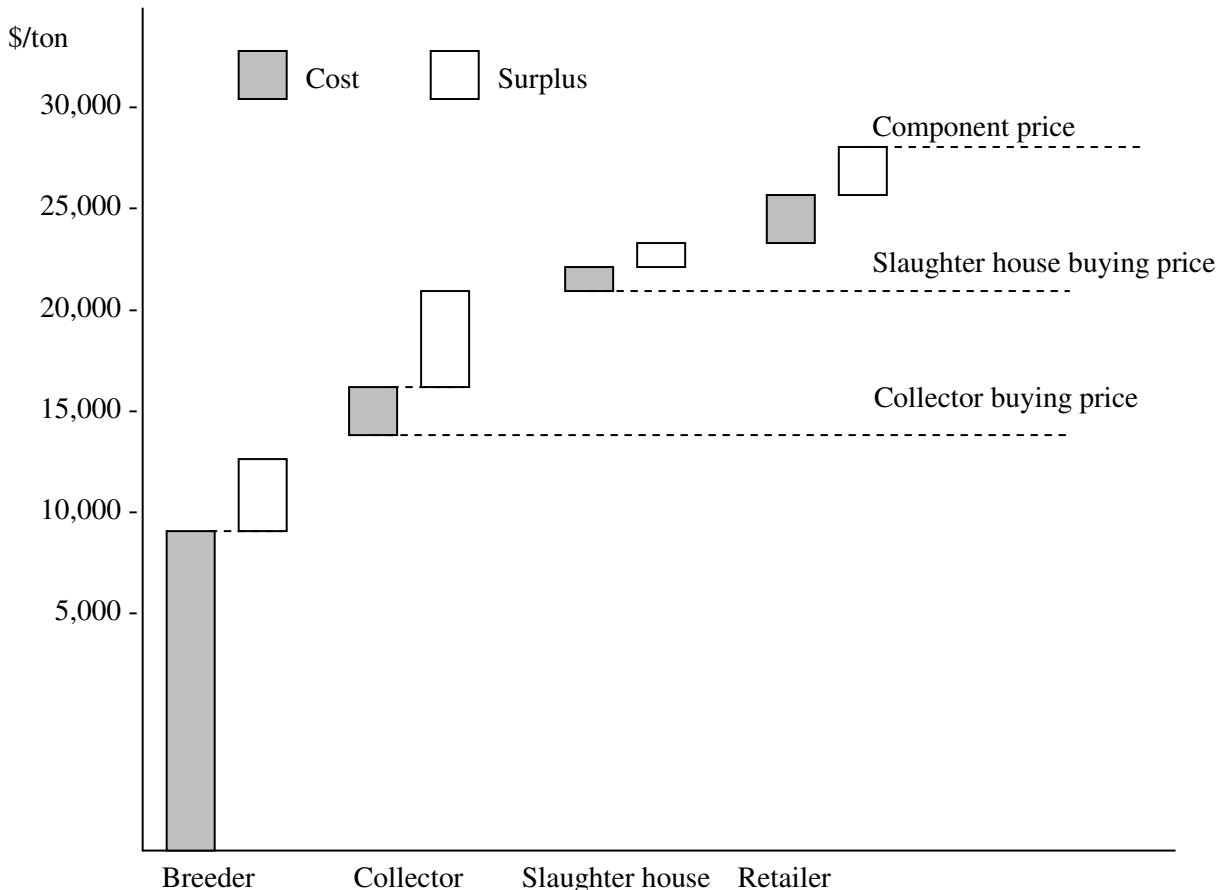
Figure 6 illustrates the division of value-created in the swine industry. Swine breeders and collectors capture a relatively larger proportion of value-created and earn high profit. However, the swine breeders face the highest risk in raising swine. Slaughter houses and retailers, by contrast, only capture modest portions of the overall value-created. They are characterized by strong price competition and low profitability. Retailers also face high risk this is due to two reasons: (1) there are many substitutes for pork, (2) retailers need to sell all their swine products within a day as these can not be stored.

In relation to contribution to value-created, the highest percentage contribution in value-created is from breeders (who also face the highest production costs). However, despite the fact that they play an important role in the swine

marketing channel, their profit is lower than of other actors (using Profit_Incremental cost ratio)

There are two ratios used to analyze the distribution of profit among actors in a channel:

$$\text{Profit margin\_total cost ratio} = \frac{\text{Profit margin}}{\text{Total cost}} \qquad (1)$$

$$\text{Profit\_Incremental cost ratio} = \frac{\text{Profit}}{\text{Incremental cost}} \qquad (2)$$

**Table 24: The distribution profit among actors**
**Unit: %**

| Actors Ratio | Breeder | Collector | Slaughter house | Retailer |
|---|---|---|---|---|
| Profit margin_total cost ratio | 30.36 | 23.42 | 0.07 | 7.03 |
| Profit_Incremental cost ratio | 30.36 | 558.06 | 17.60 | 187.24 |

These ratios show the relationship between profit margins and total cost (or incremental cost) for each actor. If the profit margin-total cost ratio is used to measure the distribution of profit among actors, the swine breeder has the highest percentage, followed by the collector, retailer and finally the slaughter house.

However if the profit_incremental cost ratio is used, the highest profit is received by the collector (558%), followed by the retailer (187%). Both the breeder and slaughter-house receive a lower profit. Thus, swine breeders spend more on production but receive a low profit, even though the risks they face are high.

Based on information from table 24, it is very hard to draw a conclusion regarding profit distribution among actors in the swine marketing channel. Further information is needed such as information related to risk assessment. Collectors have high profits, and there are low entry and exit barriers. But why do not many more collectors come in the market? Further research related to this is needed.

# 8. CONCLUSION AND RECOMMENDATIONS

## 8.1. Conclusion

The volume of swine has increased in recent years in the MD. There are five key players in the swine marketing channel: swine breeders, collectors, slaughter-houses, retailers and consumers. Most breeders are 'backyard raisers' who produce a small to medium amount of swine. Swine breeders may use many different kinds of cattle-feed for raising swine as the MD is a rich source of feed. Feeding and variety costs occupied a large proportion of production costs and consequently the cost of these things directly impacts the income of swine breeders. Swine breeders collect market information from newspapers, radio, TV, relatives, middlemen in the marketing channel as well as other sources.

The activities of breeders, assemblers and slaughterhouses are strongly affected by the internal and external environment. This includes factors such as insufficient capital, lack of techniques for raising swine, seasonable factors, price fluctuation, competition, lack of market information and risks caused by epidemic diseases. Breeders also face difficulty when expanding their business. Swine if often sold based on friendship using a basic cash transaction and contacting buyers via a message. The selling price is strongly affected by swine variety, weight after harvesting and the time at which swine is harvested.

The government has played an important role in developing the swine industry. It has issued positive policies to encourage development in the swine industry including livestock policies directed towards breeding and quality control; feeding; animal health and veterinary services; extension and agricultural research; commercialization; and marketing and distribution. In the public sector, breeders are strongly supported with policies and benefits from the Provincial Agriculture Department, Encourage Agriculture Center, and local government.

In general, the most problematic subsystem in the swine marketing channel is the distribution and marketing sector. This is due to market access problems and market information constraints. As it is difficult for swine producers to collect market information, they often have little market power.

Collectors get the highest profit margin in the swine marketing channel, followed by swine breeders, retailers and finally slaughter-houses. The swine marketing channel is relatively effective, however, market information and transportation systems can still be improved.

## 8.2 Recommendations for further research

In order to increase the effectiveness of the swine marketing channel as well as to further develop the swine industry in MD, this study suggests some areas for further research:

162

- Although breeders and other actors are able to access market information, the information is often out-of-date and unreliable. Therefore, it is necessary to conduct further research to establish a market information system that disseminates information effectively.
- The current swine marketing channel is suitable only for small scale production and local distribution. For a large market such as HCMC, suitable and effective large scale production and new marketing channels need to exist. Further research into production on a large scale is needed.
- Further research in relation to government policies and regulations for encouraging and supporting large levels of production and high quality products for export markets needs to explore, such that products are able to satisfy export conditions in foreign markets.
- Feeding and swine variety costs occupy a large proportion of total production costs. Research into the reduction of these costs is needed in order to improve swine breeder income.
- In relation to the evaluation of profit distribution among actors, research related to "risk assessment" among actors in swine marketing channel is needed.

# REFERENCES

Bain, J.S. *Industrial Organization*, 2nd Edition, John Wiley, New York,1968

Besanko, D., Dranove, M. Shanley and S.Schaefer. *Economics of strategy*, International Edition: 301-310, 2004

Cougnlan, Anne T., Erin Anderson, Louis W.Stern, Adel I.El-Ansary. *Marketing Channels*, 6th Edition, Prentice Hall.

*Decision No 34/2001/QĐ-BNN/VP (March 30, 2001) - Minister of Agriculture and Rural Development*: Session two-chapter one about "Conditions for doing business on planting, breeding variety and cattle-feed" and session two-chapter two about "Conditions for doing business on slaughtering service".

Hai LTD- Trinh BV. *Marketing solutions for improving the channel of distribution of livestock in Cantho, Haugiang, Angiang and Vinhlong provinces,* Working paper, 2004.

Hai LTD. *The analysis of swine marketing costs and swine distribution system in selected provinces in the Mekong River Delta-Vietnam,* Ph.D graduate thesis, 2003.

Hai LTD. *The Organization of the Liberalized Rice Market in Vietnam,* Center for Development Studies, UOG, 2003.

Hang LT. *Analysis the situation of household sow production and consumption in Mekong River Delta*, under-graduate thesis 2005, Cantho University.

Nam MV. *The effects of economics policy on livestock industry in the Mekong Delta, Vietnam*, Ph.D graduate thesis, UPLB, 2003.

Philip Kotler, *Marketing Management*, 8th edition, Statistics Publishing House.

Statistical yearbook 2004

# MARKET STRUCTURE & MARKETING CHANNEL ANALYSIS:
# THE CASE OF ORANGES IN THE MEKONG DELTA - VIETNAM

**Nguyen Pham Thanh Nam**
**Truong Chi Tien**
**Luu Thanh Duc Hai**

# 1.    INTRODUCTION

## 1.1.    Background of the Study

In recent years, the Vietnamese fruit sector has been rapidly developing. Vietnam (VN) has the potential to become one of the largest fruit exporting countries in the world. The value of fruit exports was 213 million USD in 2000 and by 2001 it had reached 300 million USD. This is in comparison with the 1991-1999 periods where exports were a mere 49.8 million USD. This increase in exports indicates great capacity for fruit production and large potential for the fruit export market in general. Fruit production in Vietnam has advantages such as: abundant varieties of fruit, favorable natural conditions, a large labor force and mass production ability. Total fruit cultivation area increases 6.5 percent annually on average, as compared with the previous decade (R.H. Ford *et al.*, 2003). Every year Vietnam produces 5 million tons of fruits, 15-20 percent of which is exported to other countries and the rest is consumed on the domestic market via different networks (Hai, T.T.B., 2004). In addition to favorable natural conditions, the Vietnamese government has offered new policies to stimulate the re-orientation of land use. At present, there are a number of farmers in the Mekong River Delta (MRD) growing fruit crops instead of rice, due to the attractive profit from fruit production.

Nevertheless, the Vietnamese fruit sector has faced unstable and unsustainable development. In fact, after several years of achieving very impressive growth in fruit exports, the value of Vietnamese exports was only 200 million USD in 2002, a serious decrease in comparison with 2001 (Vinafruit). In terms of fruit production, many farmers in the MRD cut down on fruit crops in order to plant other crops as the market price of fruit was so unpredictable (Hai, T.T.B., 2004). This may imply that weaknesses exist in the Vietnamese fruit marketing system which limit competitiveness.

With market globalization, the pressure of competition in the Vietnamese fruit sector has greatly increased. The Vietnamese fruit sector is confronted with competitors, not only in the international market but also in the domestic market. This includes countries such as Thailand (the number one fruit export country in the World) and China (R.H. Ford *et al.*, 2003). In order to meet the ambitious objectives of the Vietnamese government and Vinafruit, stable fruit production and effective and efficient fruit marketing needs to be achieved.

## 1.2.    Objectives of the study

This study offers an in-depth understanding of the market structure and marketing channel of oranges, one of the key fruit products in the MRD region. In addition, the study identifies further research aimed at identifying options for

enhancing the competitive capacity of the fruit marketing system as an effective supply chain.

In order to reach this objective, the following steps are taken:

(1) To analyze the status quo of production systems for orange in the MRD;
(2) To analyze orange distribution channels from fruit growers to final consumers, particularly in relation to distribution structure and interactions among major participants in the channel;
(3) To identify key weaknesses and constraints/barriers which limit competitive capacity of the Vietnamese orange sector;
(4) To suggest areas of further research and/or programs that support the development of an effective and efficient orange marketing system in the MRD – Vietnam.

## 1.3.  Research Methodology

In this study, the SCP approach is integrated with the marketing channel approach and the division of value-created approach. In addition, domestic resource cost (DRC) analysis is used to present comparative advantages in the production of oranges in the MRD. These approaches are used as a guidelines, to identify different aspects of the problem.

According to the SCP model, there is a dynamic relationship between market structure, conduct and performance. Market structure and market conduct influence market performance. In turn, market performance will influence market structure and market conduct in the long run (See Figure 1.1 below). Performance in particular industries or markets, depends upon the conduct of sellers and buyers with regard to pricing policies, product line, investment in production facilities, and so on. Conduct depends in turn upon the structure of the relevant market, including such features as the number and size distribution of sellers and buyers, the type of marketing channel, the degree of product differentiation, the presence or absence of barriers to the entry, etc.



**Figure 1.1:   Dynamic model derived from the SCP approach**
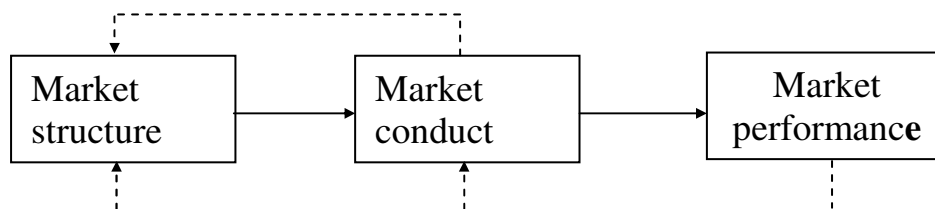
In his 2003 paper, Hai applied the SCP model and integrated some concepts of the theory of institutional economics and the marketing channel approach. Table 1.1 (page 5) presents the principal aspects used by Hai.

As thousands of producers and collectors are involved in the orange market, we can assume that competition is high. Therefore, there is not much room for

170

actors in the market to behave independently; they have to follow the market rules as defined by structural elements (Bain, J.S., 1968). In this paper, the element of "buyer and seller concentration" will not be considered as thousands of orange growers are small scale producers; and hundreds of assemblers, wholesalers and retailers are small scale traders. Thus, buyer and seller concentration is not a relevant element and will not be used in this study.

**Table 1.1    Elements of Structure-Conduct-Performance**

| Elements of structure | Elements of conduct | Elements of performance |
|---|---|---|
| - Intermediaries involved in the marketing system | Conduct with respect to:<br>- Buying | - Effectiveness of supplied services; product suitability in relation to consumer preferences |
| - Barriers to entry and exit | - Selling<br>- Transport | - Efficiency of supplied services |
| - Buyer and seller concentration | - Storage<br>- Negotiation | + Rate of profit in relation to marketing costs and price |
| - The assortment of product quality | - Processing<br>- Information | margins (arbitrage in time, space and form). |
| - Distribution of market information | - Finance/risks bearing<br>- General trading | + Transaction cost analysis (market searching; negotiating |
| - Structure of marketing channels | strategies that traders conducted in order to | and concluding a contract; enforcing a contract) |
| - Price formation process | follow market rules and | + Analysis of price differences and |
| - Rules and/or regulations that coordinate market exchange. | increase marketing efficiency (reduce transaction costs) | seasonal price fluctuation<br>+ Market integration<br>- Dynamic analysis of the market process |

*Source: Luu Thanh Duc Hai, 2003*[8]

In addition, in analyzing the elements of performance, due to data limitations this paper will not evaluate the efficiency of marketing channels, market integration, and transaction costs. In Hai's model, one of the components used is an analysis of "margin". We also apply this method and use the result to analyze the distribution of value-created among actors in the supply channel. Consequently, Table 1.1 was modified into Table 1.2 which contains the elements under study in this paper.

---

[8] Luu Thanh Duc Hai (2003). *The organization of the Liberalized Rice Market in Vietnam*

**Table 2:    Modified Elements of Structure and Performance**

| Elements of structure | Elements of performance |
|---|---|
| - Intermediaries involved in the marketing system | - Effectiveness of marketing channels; supplied services; product suitability in relation to consumer preferences |
| - The existences of entry and exit barriers | |
| - The assortment of product quality | |
| - The distribution of market information | - Value-added and value created analysis to identify where the economic value is created within a value chain |
| - Price formation process | |
| - Rules and/or regulations that coordinate market exchange. | - Analysis of price differences and seasonal price fluctuation |

**Elements of market structure**

For market structure, actors/intermediaries involved in the marketing system were interviewed. The information gathered was used to define a general picture of the channel. The term intermediary refers to any channel member other than the manufacturer or the end-user. The marketing channels information is also integrated into the first element of market structure (actors/intermediaries). Marketing channels are defined as the flow of products from the place of production to the place of ultimate consumption. Marketing channels help to determine the relationships between different actors in the markets.

Secondly, we focus on competition by using three major criteria: the existence of entry and exit barriers, the assortment of product quality and distribution of market information.

(1) The existence of entry and exit barriers influences the competitive relationship between firms and potential entrants. If the barriers to entry and exit are minimal, new firms can easily enter into and exit from the orange markets and compete with established firms. However, with the presence of very high barriers to entry and exit, established firms become well protected from potential rivals[9]. There are three main types of structural entry barriers: (i) Control of essential resources: an incumbent is protected from entry if it controls a resource necessary for production; (ii) Economies of scale and scope. When economies of scale are significant, established firms operating at or beyond the minimum efficient scale will have a substantial cost advantage over smaller entrants. Economies of scope in production stem from the flexibility in materials handling and scheduling that arises from having multiple production lines within the same plant. Economies of scope in marketing are due to substantial up-front expenditures on advertising that are needed for a new entrant to establish a minimum acceptable level of brand

---

[9] Philip Kotler. *Marketing Management, 8th*

awareness. Economies of scale and scope create barriers to entry because they force potential entrants to enter on a large scale or with many products to achieve unit cost parity with incumbent firm; (iii) marketing advantages of incumbency. Exit barriers arise when firms must meet obligations whether they produce or not (Besanko, 2004). In the case of oranges, the entry and exit barriers will be measured by lack of working capital, unstable output market, severe competition, fluctuation of market price and market information.

(2) The assortment of product quality examines the extent to which sellers differentiate, distinguish or express their specific preferences among competing products of the various sellers. Factors such as product quality and kinds of product marketed are common attributes of product differentiation. In the case of oranges, product differentiation both at the farmers' and the traders' level are examined in terms of different kinds of orange; degree of size/weight; and different in maturity level.

(3) The distribution of market information refers to the availability of relevant market information. This could be expressed by assessing the producers' awareness of the market price, the manner by which price information is disseminated among producers. The distribution of market information shows how market information is disseminated to producers and traders, what/who are the sources of market information and the adequacy of this information in terms of risk reduction.

The process of price formation is determined by the following fundamentals: market power, bargaining skills, and transaction specific characteristics such as the quality of product, volume of sales per transaction, and sales location. In general, a large trader usually has high market power when setting prices in the market. The quality of the product is related to consumers' preferences. Sales volume expresses the sales of traders and retailers. Finally, sales location will directly effect the price of a product as transport costs may be significant.

Rules and/or regulations that coordinate market exchange: focuses on a description of the role of government in the orange market and major policy and regulation changes to promote orange trading.

**Elements of market performance**
Analyzing market performance we focus on the degree of effectiveness in marketing system.

*Effectiveness* means that marketing channels should offer proper service outputs. It means that the distribution channel has to meet the demand for services expressed by consumers. First of all, the marketing channel has to provide the following generic services: exchange functions (ordering, assembling, negotiation, market information, payment and distribution), physical functions (storage, processing, transport) and facilitating functions

(grading, financing)[10]. In the case of oranges, the key functions of generic services will be examined to discover whether each function is working well.

## *Division of value- created*

Value-created is the difference between the benefit B and the unit cost C of the product.

Value-created   = Consumer surplus + Producer's Profit
                = (B – P) + (P – C) = B – C      Where: B is benefit; C is cost.

Value-added analysis is a tool for understanding where economic value is created within a firm's value chain.

The value-added analysis proceeds as follows:

- Value-added in manufacturing = profit that would have been made if all products of producer are sold to the next actor in the channel
- Value-added in distribution = incremental profit made by self-distributing products to retailers or to wholesalers[11]

Figure 1.2 illustrates the division of value-created in one industry. Actor 1, 2 and 3 capture only modest portions of the overall value-created. They are characterized by strong price competition and low profitability. Distributors and actor 4, by contrast, capture a relatively larger proportion of value-created and earn high profit.

Division of value-created will be applied in the case of oranges. Each actor in the orange marketing channel will be analyzed based on their production costs, incremental cost and marginal profit in order to define the distribution of profit among actors. Two ratios will be used in analyzing: profit margin total cost ratio and profit incremental cost ratio.

$$\text{Profit margin total cost ratio} = \frac{\text{Profit margin}}{\text{Total cost}} \qquad (1)$$

$$\text{Profit Incremental cost ratio} = \frac{\text{Profit}}{\text{Incremental cost}} \qquad (2)$$

---

[10] Anne T.Cougnlan, Erin Anderson, Louis W.Stern, Adel I.El-Ansary, PP 10, Marketing Channels, 6th Edition, Prentice Hall.
[11] D.Besanko, D.Dranove, M. Shanley and S.Schaefer, *PP 418-419, Economics of strategy, International Edition*

**Figure 1.2  Division of value – created in the production of one industry**
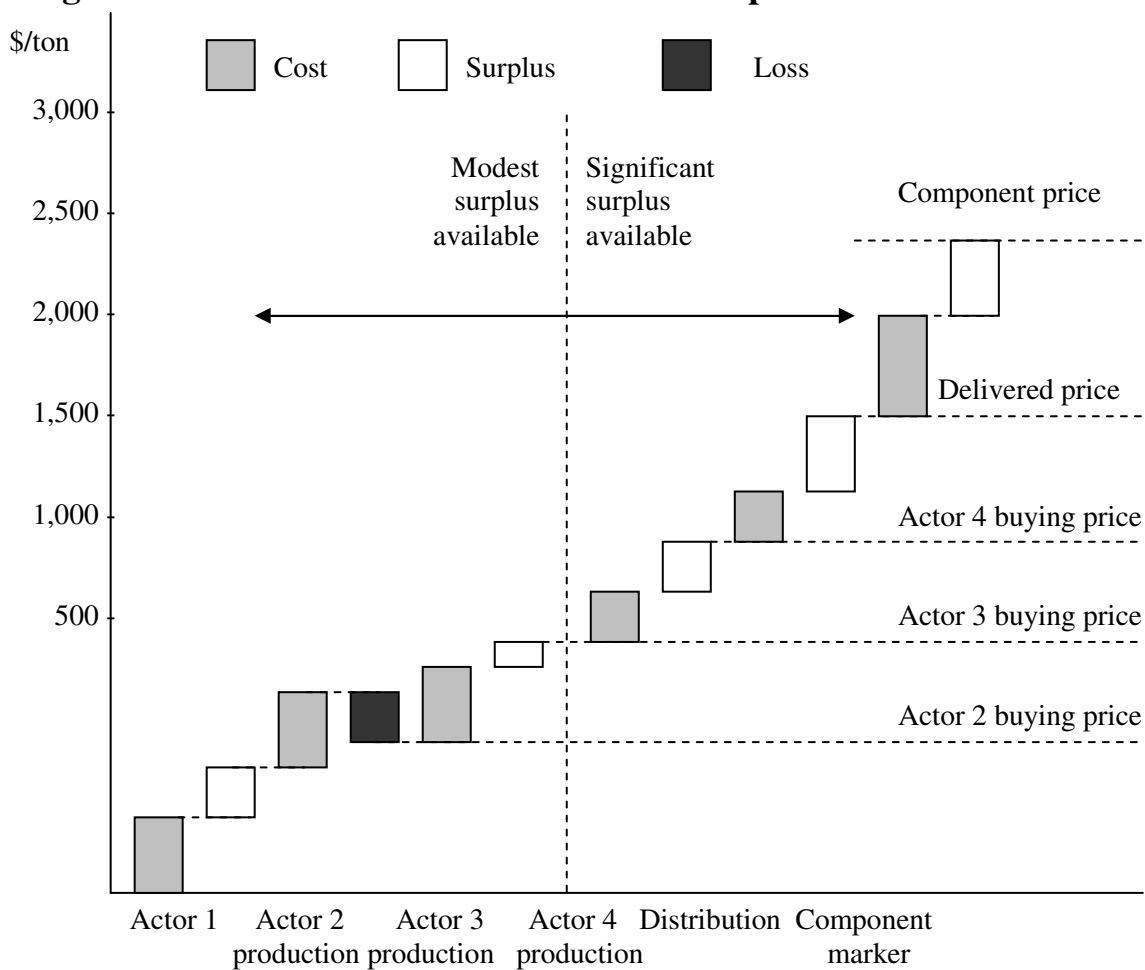
These ratios show the relationship between profit margin and total cost (or extra cost) that each actor earns. A comparison between these ratios for each actor in distribution channel will be performed to determine which actor has high percentage of profit in order to identify reasons why the profit of each actor is distributed differently. It will also form the basis for further research.

Primary data is collected to estimate the production costs of producers; marketing costs and marketing margins of various traders. From these results, total cost and total-marketing costs of various marketing channels can be calculated. Direct marketing costs include labor, materials for packaging, fuel and electricity, taxes and licenses. The percentage share of each cost item for each type of trader is computed.

Profit margin measures the rate of return on gross sales after all costs involved in rendering marketing services have been deducted. The profit margin will be calculated as follows:

| Profit margin of each type of trader | = | Total marketing margin of each type of trader | – | Variable marketing cost of each type of trader |
|---|---|---|---|---|

Domestic resource cost (DRC) analysis is used to present any comparative advantage in the production of a given crop for a particular country. DRC compares the opportunity costs or shadow prices of domestic resources used in production with the value-added that it generates. A country has a comparative advantage in the production of a commodity if the social opportunity cost of producing an incremental unit is less than the border price of that commodity (Pearson *et al.*, 1976). DRC also expresses the efficiency of alternative domestic production activities by indicating the total value of domestic resources required to generate or save a unit of foreign exchange (Shahabuddin, 2001).

## 1.4. Data Collection

The methodology used in this study is a synthesis of findings of several relevant studies which has been supplemented by results from research conducted in 2005. Actors in the fruit supply chain in the MRD were interviewed. Interviewees comprised 20 fruit growers and 20 traders including assemblers, wholesalers and retailers in two provinces: Vinhlong and Cantho, where Citrus orange and Honey orange are grown commonly. Primary information is used to assess problems, constraints, obstacles, and barriers which face participants in the orange marketing system. The data is then used to estimate marketing costs and margins. The results of the survey demonstrate the behaviour of traders.

In terms of key secondary data, the annual price of oranges from 1990 to 2001 was gathered and used to demonstrate fruit price trends during this period. In addition, the monthly price of orange in 2004 was also collected in order to measure seasonal price variability.

## 1.5. Organization of the Study

The study is organized into 5 sections. The introductory section presents a statement of problem, the objectives of the study, the research methodology and the scope of the study. Section 2 gives an overview of fruit production and trade in Vietnam and in the MRD in particular. Section 3 presents an analysis of the structure of the orange marketing system in the MRD. The strengths, weaknesses and constraints of the orange marketing system in Vietnam are also outlined in this section. Section 4 analyses the performance of the orange market in the MRD. Production and marketing costs and profit margins between various actors in the orange marketing channels are estimated and analyzed. Furthermore, the trend of orange market price and seasonal orange price variability is demonstrated. Finally, conclusions and recommendations for further research and programs for developing an effective and efficient orange marketing system in the MRD are suggested in section 5.

# 2. OVERVIEW OF FRUIT PRODUCTION INDUSTRY

Let us first look at the production activities, competitive strengths and output of the Vietnam fruit sector.

## 2.1. The growth of fruit trees

Land area devoted to fruit trees in Vietnam has increased over past years (excluding 1998 which had a 9.78% decrease in land area as compared with 1997). In 1999, there was a fruit tree land area increase of 19.03%, equivalent to 496,000 hectares. During the 10 years from 1995-2004, the area increased substantially. In 1995 it was 346,000 hectares while by 2004 the area had increased 216%, equivalent to 747,800 hectares, an annual growth rate of 8.9%.

**Table 2.1    Land Area of fruit trees in Vietnam 1995-2004**

| Years | Land area (1000 ha) | Growth (%) |
|---|---|---|
| 1995 | 364,4 | - |
| 1996 | 384,8 | 5.59 |
| 1997 | 426,1 | 10.73 |
| 1998 | 384,4 | -9.78 |
| 1999 | 496,0 | 29.03 |
| 2000 | 544,7 | 9.82 |
| 2001 | 609,6 | 11.91 |
| 2002 | 677,5 | 11.14 |
| 2003 | 692,2 | 2.17 |
| 2004 | 747,8 | 8.03 |

*Source:   Synthesis from the General Statistical Department, the Ministry of Agriculture and Rural Development, the Agricultural Planning & Design Institute and Department of Agriculture of provinces, 2004.*

Longan plantations had the largest area of 122,000 ha (16.4% of other fruit trees) out of 747,800 ha in 2004. Segmental fruit trees (orange, buoi (grape-fruit), quit (tangerine) ranked second with an area of 11,00 ha (15,3%). Third was banana third with an area of 122,091 ha (14%), forth was Litchi 87,700 ha (11.7%) and fifth mango 79,300 ha (10.6%). Land area for fruit trees seems to be expanding non-stop and there is a high growth in productivity. Nationwide, there was 6.2 tons of fruit of numerous varieties.

The VN fruit sector has a lot of prospects with a growth in total planting area of 6.5% over the last decade, on average. This growth rate is double that of food plants, however, it is less than industrial trees. In spite of its high growth, there is a low ratio of fruits to total agro-productivity. Most of farming families plant fruit trees and vegetables, 85% grow at least one kind of fruit tree or vegetable.

Fruit is mainly sold and not personally consumed. 74% of the fruit is sold on local markets. In domestic market, Vietnamese fruit consumption is mainly in the South, which about 67% of fruit production quantity. The rest is consumed in the North and other regions of the country.

Segmental fruit trees (orange, buoi (grape-fruit), quit (tangerine) are mainly cultivated in the Mekong Delta. They have had a fast increase in land area and have a productivity level ranked second only to Longan.

The figure in Table 2.2 shows that from 2003 to 2004 Can Tho (including Hau Giang), Tien Giang, Vinh Long, Ben Tre and Dong Thap had the largest land area for cultivation, products and productivity. These provinces have had a long tradition of planting fruit trees in the Mekong Delta. Kien Giang and An Giang plant grape-fruit (Buoi) due to the financial gain obtained. Few fruit trees are found in Bac Lieu or Ca Mau. If they are found, there are very few trees which are productive.

Table 2.2.    Land area and segmental fruit trees in the Mekong Delta 2003-2004

| | 2003 | | | | | | 2004 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Orange | | | Grapefruit | | | Orange | | | Grapefruit | | |
| | Area (hectare) | Area for Product (hectare) | Production (ton) | Area (hectare) | Area for Product (hectare) | Production (ton) | Area (hectare) | Area for Product (hectare) | Production (ton) | Area (hectare) | Area for Product (hectare) | Production (ton) |
| Mekong Delta | 40.800 | 28.900 | 351.900 | 11.900 | 6.200 | 81.200 | 45.970 | 32.228 | 381.820 | 14.234 | 8.298 | 108.916 |
| L.An | 100 | 100 | 500 | 0 | 0 | 0 | 109 | 100 | 427 | 28 | 21 | 105 |
| Đ. Tháp | 2.600 | 1.900 | 22.200 | 200 | 100 | 800 | 2.142 | 1.927 | 19.881 | 147 | 128 | 734 |
| A. Giang | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 12 | 13 | 0 | 0 | 0 |
| T.Giang | 6.200 | 3.200 | 56.900 | 333 | 1.700 | 28.500 | 7.503 | 4.861 | 84.520 | 3.388 | 2.596 | 43.039 |
| V.Long | 7.700 | 5.300 | 50.800 | 4.200 | 2.200 | 27.700 | 6.959 | 4.139 | 41.007 | 5.722 | 3.360 | 41.638 |
| Bến Tre | 7.400 | 4.900 | 80.500 | 1.200 | 500 | 8.400 | 10.002 | 5.613 | 78.982 | 1.742 | 736 | 10.419 |
| K.Giang | 0 | 0 | 0 | 0 | 0 | 0 | 1.395 | 1.375 | 2.503 | 0 | 0 | 0 |
| Cần Thơ | 12.400 | 10.400 | 110.000 | 1.400 | 1.000 | 10.000 | 12.521 | 10.531 | 117.300 | 677 | 459 | 4.730 |
| Trà Vinh | 2.300 | 1.800 | 19.500 | 800 | 300 | 3.800 | 2.803 | 1.975 | 21.313 | 955 | 441 | 5.124 |
| S.Trăng | 2.100 | 1.300 | 11.300 | 1.100 | 400 | 1.900 | 2.509 | 1.805 | 15.864 | 1.575 | 557 | 3.127 |

*Source:  Agriculture Planning & Design Institute and Department of Agriculture of Provinces (Distributed by SOFRI)*

## 2.2. Effectiveness and DRC advantage in the Mekong Delta's fruit industry

As the cultivation of fruit trees in Vietnam and in the Mekong Delta is generally more profitable than other plants, the sector has grown significantly. In fact, the value of fruit is 10 times higher than rice per ha. Hai (2002)'s survey of the effectiveness of the fruit industry showed that Sanh orange, Nam Roi grape-fruit, mango and durian trees bring about very high profits. Table 2.3 below shows the ratio between benefits and investment into such fruit trees as orange: 8.69; mango 8.82; Nam Roi grape-fruit 10.07 and durian 13.57. This is compared with 3 rice crops annually were the ratio is only 0.49. In terms of returns, this implies that an investment of 1 VND into oranges will receive return of 8.69 VND; Nam Roi grape-fruit, a return of 10.07 and rice a mere 0.49 VND.

## Table 2.3. Economic effectiveness of some other crops

| Plant | Average price (1,000VND per ton) | Income (1,000VND per hectare) | Gains (1,000VND per hectare) | Profit/Investment Capital |
|---|---|---|---|---|
| Rice | 1,500 | 3,808 | 2,452 | 0.49 |
| Corn | 2,500 | 3,149 | 2,466 | 1.66 |
| Grapefruit | 7,000 | 151,305 | 143,145 | 10.07 |
| Orange | 6,000 | 95,551 | 89,693 | 8.69 |
| Rambutan | 3,000 | 61,073 | 55,880 | 3.32 |
| Longan | 4,000 | 62,350 | 55,591 | 3.88 |
| Mango | 5,000 | 86,136 | 80,837 | 8.82 |
| Durian | 10,000 | 151,956 | 149,022 | 13.57 |

*Source:     Hai, T.T.B., (2004). "Development Orientation of the Fruit Processing Sector for Vinh Long Province to 2010*

When the evaluative index, DRC, is applied to analyze the comparative advantage of the Mekong Delta's fruit industry, comparative income and interest are found to be high, even at the lowest price level (Hai, 2002). The three crops with the highest comparative advantage include: durian, grapefruit and orange. If durian sells at the lowest price (5,000 VND/kg) the DRC index is 0.11, income is 72 million VND and interest is 69 million VND/ha. If it sells at the highest price DRC is 0.09 and interest is 143 million VND.

When the DRC of oranges is 0.11, interest is 89 million/ha. The survey results show that that if the price of labor increases 1.5 times and the cost of land use

doubles, fruit trees still have a comparative advantage with income and interest still higher than other annual crops

## 2.3. The fruit output

Vietnam produces approximately 3.8 million tons of fruit and 5 million tons of vegetables annually. Exports are equal to approximately 15-20% of total product value as the majority is consumed locally. Processed products that have been canned, dried or frozen account for 85-90% of total export products. (T.K.Thi, FAO and MARD, 2000)

Vietnam is the top producer of fruit in South East Asia. However, exports of fruit are declining. For instance, in 2001, the export turnover of fruit and vegetables (mainly fruit) for the nation reached 333 million dollars, By 2002 this had decreased to 220 million dollars, and by 2003 it had decreased further to 182.5 million dollars. 2004 saw no signs for optimism.

In the Mekong Delta price of durian dropped from 25,000 VND/kilo to 6,000-7,000 VND/kilo. The price of Hoa Loc mangoes and rambutans declined 50%-300% in comparison with prices in May, 2004. In 2002, the export markets faced a sharp drop due to newly established regulations in China, the biggest importer of Vietnamese products. The media reported that the export of fruit to China declined another 40% in March, 2003 (Fruit Export to China, Vietnam, 3 April 2003). Export activities of fruit in Vietnam from 1991-2002 are illustrated in the Table 2.4.

Export turnover primarily comprises exports to China, Laos and Cambodia at the border which are considered "easy-to-please" markets. However, Vietnam fruit has also been introduced into "hard-to-please" markets such as the USA, Japan, Taiwan, Australia and Europe which have strict requirements on quality. In order to increase consumption further in those markets, Vietnamese fruit needs to further comply to international standards.

China, Taiwan, Japan, Hong Kong and Russia are the main importers of Vietnamese fruit. Sales conducted through private brokers have reduced producers' profits. Sales are risky as the payment is done at different times without an ensured credit letter. Only when the lot (container) of fruit is delivered is the final payment made.

While most of fresh fruit is exported to China, the majority of canned and frozen fruit is exported to Europe and the USA. Generally, Vietnam's processed fruit has a reputation of being poorly preserved and unhealthy (including pesticides and fertilizers with a high level of poison) and the price is high. It is estimated that a loss of 20% is caused by darkened or spoiled quality fruit).

**Table 2.4. Export turnover of fruit in Vietnam 1991-2002**

| Year | Million dollar | Growth (%) |
|------|----------------|------------|
| 1991 | 33 | - |
| 1992 | 32 | -3.03 |
| 1993 | 24 | -25.00 |
| 1994 | 21 | -12.50 |
| 1995 | 56 | 166.67 |
| 1996 | 90 | 60.71 |
| 1997 | 69 | -23.33 |
| 1998 | 53 | -23.19 |
| 1999 | 70 | 32.08 |
| 2000 | 213 | 204.29 |
| 2001 | 300 | 40.85 |
| 2002 | 200 | -33.33 |

*Source: Vinafruit*

Fruit products have conquered the local Vietnam markets. However, consumers still have a psychological interest in foreign or "strange" products imported mainly from Thailand and China. Imported fruit is expensive, despite the fact that fruit imported from China is rumored to be worse than Vietnam fruit. This is due to the use of pesticides and chemicals (which are prohibited in international communities) by Chinese producers. Still, the appearance of Chinese fruit is eye-catching in different colors and packages.

The majority of the Vietnamese eat local fruit and foreigners – especially Chinese businesspersons – purchase Vietnamese fruit at the border. Generally, private companies produce fresh fruit, while state-run companies mainly produce canned and frozen fruit. The Vietnamese government intends to set up 3 major centers located in Ho Chi Minh City, Cai Be (Tien Giang) and Ha Noi to collect and buy fruit from different parts of the countries.

The main export products of Vietnam include: coconuts, apples, bananas, mangoes, longans, Thanh Long and rambutan. Tropical fruit trees mainly grow in the South of Vietnam. Although cultivation land and climate is suitable for the growth of tropical fruit, productivity is lower than the world average.

The Vietnamese government has set very ambitious objectives for the export of fruit and the Vietnamese Fruit Association (Vinafruit). Vinafruit was founded in 2001, it is currently building strategies for the fruit industry in Vietnam.

Fruit productivity per hectare is greater than other food crops, subsequently the Vietnamese government has aimed policies at the transfer of land from food crops to fruit trees. Below is a table 2.5 showing the total harvest productivity in Vietnam.

**Table 2.5. Harvest productivity and land area of fruit cultivation in Vietnam**

|  | The total productivity (ton) | Area (hectare) |
|---|---|---|
| Orange/Tangerine | 405,000 | 63,000 |
| Banana | 1,234,000 | 95,000 |
| Mango | 189,000 | 41,000 |
| Pineapple | 263,000 | 32,000 |
| Longan, Rambutan, litchi | 545,000 | 131,000 |
| Cashew | 41,000 | 168,000 |
| Coconut | 1,134,000 | 190,000 |

*Source: Vinafruit*

The rate of consumption of fruit and vegetables per capita is approximately 71 kilos/year, of which three quarters are vegetables. Spending on fruit and vegetables (including family spending) is approximately 126,000 VND per person and 529,000 VND per family, 4.5% of a family's total yearly spending. According to experts in the field:

1) Productivity and quality in the Vietnamese fruit industry are poor. Thus, Vietnamese fruit is less competitive in both the domestic and foreign markets. This poor quality is also coupled with uncompetitive prices. Although fruit from Vietnam is tasty (particularly from the Mekong Delta) it is not produced on a large scale and consequently prices are higher than those of other countries in the region, resulting in a lower level of competitiveness.

2) Areas of specialization in fruit cultivation have not been established. Although there are 27 fruit production areas, few areas are specialized. So far, specialized products include: Thanh Long (Binh Thuan), grapes (Phan Rang), Thieu litchi (Luc Ngan, Bac Ninh) and star-apple (Vinh Kim). Twenty-five percent of land area still grows a great variety of species, consequently each fruit is grown on a small scale.

In spite of the fact that this situation of non-specialization has been recognized, there is still no plan for a solution. If Hoa Loc mangoes and Com Xuong longans are not grown on a large scale, the level of fruits produced will be insufficient to meet the demand of local and export markets. Without planning, farmers are unsure which fruit trees to plant and cannot grow on a large scale.

3) Consumption of agro-products among farmers is habitual i.e. using the farmers-market. No large-scale-market exists for the sale of fresh fruit in the western Mekong region (except the floating markets, Phong Dien and Cai Rang), only a few systems of collective production. However, there are plans for the building of wholesale markets.

In Tien giang, in addition to a national 12-hectare fruit trade center (in Hoa Khanh, Cai Be District with building investment of VND 92 billion) there are plans for wholesale markets such as Long Trung (Cai Lay District), Vinh Kim (Chau Thanh District) and Thanh Tri (Ward 4, My Tho City).

Currently, only the infrastructure of the national fruit trade center in Hoa Khanh has been built. The building of wholesale markets in Vinh Kim and Thanh Tri has also just started. The Dong Thap provincial authorities have also approved the building of wholesale markets in My Hiep, Cao Lanh District.

The Ben Tre provincial authorities have also decided to approve an investment of VND 9.3 billion – from the wholesale market development capital granted by the Central government – to build a wholesale market in Luong Quoi (Giong Trom District).

The People's Committee of Can Tho City has also approved the building of a wholesale market in An Binh (Can Tho City). In the meantime, trolleys of fruit with a "SALE OFF" notice drag themselves to every corner of the region.

4) Trademarks are a barrier which can lead to a decline sales and profits, particularly the use of trademarks from foreign companies. For example, Thanh Long fruit is a top quality fruit it the region, however, businesses in Long An and Tien Giang exporting to Taiwan have to use Taiwan labels. Vietnamese fruit trademarks are not yet established on world markets.

## 2.4. Influences of government and management agencies' policies on oranges in the Mekong Delta

The Vietnamese government and local authorities have issued and implemented numerous policies in order to encourage the development of the fruit industry. These policies have positive significance for the expansion of cultivation land area and productivity nationwide. In particular, the Mekong Delta.

1. **Promotion policies for the export of products including vegetables**. In Decision 133/QD-TTg approved by the Prime Minister, credit rules to support export activities were established. These rules gave priority to exports in all economic sectors. Priorities confirmed in Instruction 31/2001/CT-TTG dated December 31, 2001 allow exporters of vegetable products to receive preferential loans as well as rewards based on their turnover. Investors in other economic sectors now have an incentive to invest in and grow fruit trees. This has lead to a rapid increase in fruit exports (Table 2.4).

2. **Policies on farm economics and the encouragement of the single-area planting of specialized fruit trees** These policies have been implemented to encourage investors (and farmers) to expand production and focus on specialized farming by using favorable government loans. As a result, the farming economy has developed impressively, both in terms of quantity and of scale.

**Table 2.6.  Number of farms by regions (2004)**

|  | Total | Annual trees farm | Perennial Trees farm | Livestock farm | Fishery farm |
|---|---|---|---|---|---|
| The country | 110,832 | 32,961 | 22,759 | 9,967 | 35,424 |
| Red river Delta | 8,131 | 347 | 619 | 2,473 | 2,478 |
| North-East | 4,984 | 121 | 1,134 | 400 | 1,027 |
| North-West | 400 | 45 | 83 | 106 | 14 |
| North-Middle | 5,882 | 1,551 | 1,081 | 556 | 1,160 |
| Middle coastal | 6,936 | 1,831 | 793 | 552 | 2,956 |
| Central Highland | 9,450 | 1,399 | 6,887 | 551 | 64 |
| South-East | 18,921 | 1,959 | 9,693 | 3,101 | 3,125 |
| Mekong River Delta | 56,128 | 25,708 | 2,469 | 2,228 | 24,600 |

*Source: GSO (2003)*

In addition, a project to encourage the production of high-quality fruit tree species has been introduced in the south of Vietnam. This project encourages investment into the production of specific fruit tree species – particularly high-quality species – and provides support for provincial plant variety centers and individuals investing in high-quality and disease-free plant species. Unfortunately, both private and state-run plant variety centers are unable to meet the demand for these plant species. As a result, investment into the production of high-quality plant varieties is needed such that low-quality plant varieties can be replaced.

3. **A joint project for the production and consumption of 'safe' fruit in the Tien River area.** This project was founded when the project management board was launched on March 21, 2005. The project helps farmers to produce fruit which meet EUREP-GAP standards. EUREP-GAP standards for food safety comprise standards for production, hygiene, work environment and origin tracing.

If sustainability is a priority for the government and there is integration into the regional and world economy, an opportunity is created for the development of the country's economy, particularly in the fruit tree industry in regions such as the Mekong Delta.

# 3.  STRUCTURE OF THE ORANGE MARKET IN VIETNAM

This section introduces about the production of oranges, presents the supply chain and examines the competitiveness of the orange market.

### 3.1. Description of the Product: Oranges
An orange's product life cycle is approximately 10 years, including 3-4 years of growing before the initial harvest. Initially, farmers have to invest capital into seedlings, land preparation, fertilizing, spraying pesticide, etc. During the harvesting period (from year 4 to 10), farmers begin to generate income (and profit) from selling the oranges. Then, after 10 years, farmers will need to replant new orange trees and restart the process, as after this time orange quality and yield decrease.

**Steps of Production**
- Land preparation: dig ditches and pile
- Planting seedlings and growing time
- Watering and weeding
- Fertilizing and spraying pesticide
- Pruning
- Spraying bloomed chemical and fruit nutrilite
- Harvesting/picking fruit

**Production – Yield capacity**
By applying new scientific techniques, orange farmers can control their crop and generate a higher income. The main orange crop is from October to December with yields of about 22 – 27 tons/ha. In this period, orange quality is higher than the unseasonable crop, however because of the quantity on the market, the prices are lower.

The unseasonable crop, from May to July, yields only about 10 – 15 tons/ha and produces lower quality oranges. However, the price of oranges is higher. The profit margin of farmers during the sale of the main crop is approximately 51,593,000 VND, lower than the profit margins of orange growers during the sale of the unseasonable crop, who receive approximately 96,593,000 VND (see table 4.3 in the Section 4).

## 3.2. Description of Product Supply Chain

Intermediaries involved in the supply chain of oranges include assemblers, wholesalers, retailers and facilitators as shown in Figure 3.2.

**Orange Assemblers** (also known as the traders/transporters): Assemblers are the first link between the orange farmers and other middlemen. They collect several small lots of oranges from different growers and combine them into a single load at one location. The key function the assembler provides in addition to assembly is transport.

- **Local orange assemblers**
  Local assemblers are usually local people with an in-depth knowledge about cropping patterns, the quality of different kinds of oranges and the production traditions of orange farmers. The local orange assemblers may be farmers located in the village. Normally, they will have a small boat (1-2 tons capacity) which is used for transportation and a small amount of working capital (around 1 million VND) at their disposal. Local assemblers purchase oranges directly from farmers and transport them to orange wholesalers, cooperatives or sell them at local trading places. [12]

- **Orange assemblers/wholesalers**
  Orange assemblers/wholesalers are middlemen who are usually located near the market place (for example, on the side of the road or near the river/canal where products can easily be loaded and unloaded). The assembler/wholesalers usually own a medium sized boat (around 3-5 tons), but do not own stalls in the market. They buy large amounts of oranges and ship them to the orange wholesalers.

**Orange Wholesalers:** Orange wholesales collect various loads of oranges and place them into large, uniform units (an activity which contributes to price formation). In so doing, orange wholesalers provide information to suppliers (e.g., orange farmers and rural orange assemblers) and assume the varying degrees of risks associated with the transfer of property rights. Wholesalers facilitate mass and specialized storage operations, transportation and, in general, subsequent distribution operations involving retailers.

Orange wholesalers own stalls or warehouses, which are usually located along the canal, river or main road. They usually have a long experience with orange/fruit trading, strong relationships with other orange traders and good knowledge on orange quality and market prices. Wholesalers will buy a large amount of oranges from local assemblers and/or assemblers/wholesalers and ship the oranges to other provinces through what is known as 'long-distance buying-selling'.

---

[12] The case of Tam Binh District – Vinh Long Province.

**Orange Retailers:** The main function of the orange retailer is to buy wholesale oranges and sell them, in various forms and quantities, to consumers at a convenient location and time. Orange retailers can take on 2 different roles: (1) orange retailer-assemblers, involved in buying to complement their stock and (2) retailer-distributors, involved in selling from their stock. Orange retailers often buy from wholesaler-distributors or brokers and resell to consumers. They may also travel to orange production areas. At harvest time, when the villages in the vicinity of the market hold a surplus of oranges, retailers may prefer to purchase orange directly from farmers.

Orange retailers may have a fixed base: a stall, a shop or a place on the ground, or alternatively they may be hawkers, who carry their products to buyers.

**Facilitators:** There are several types of facilitators operating in the orange market, who provide different services to traders. Usually, they are groups of private transporters who provide transport facilities (mostly boats and trucks) to traders. Facilitators may be operating as warehousing firms, providing good storage services to traders. Other facilitators may act as: money suppliers, banks, quality control services, tax offices, and other agents for market regulation.

One important facilitator in this study is a group of private traders and local authorities who established the "central wholesale market place" in order to assist orange traders with the buying and selling of their product (the case of Tam Binh and Thu Duc market).
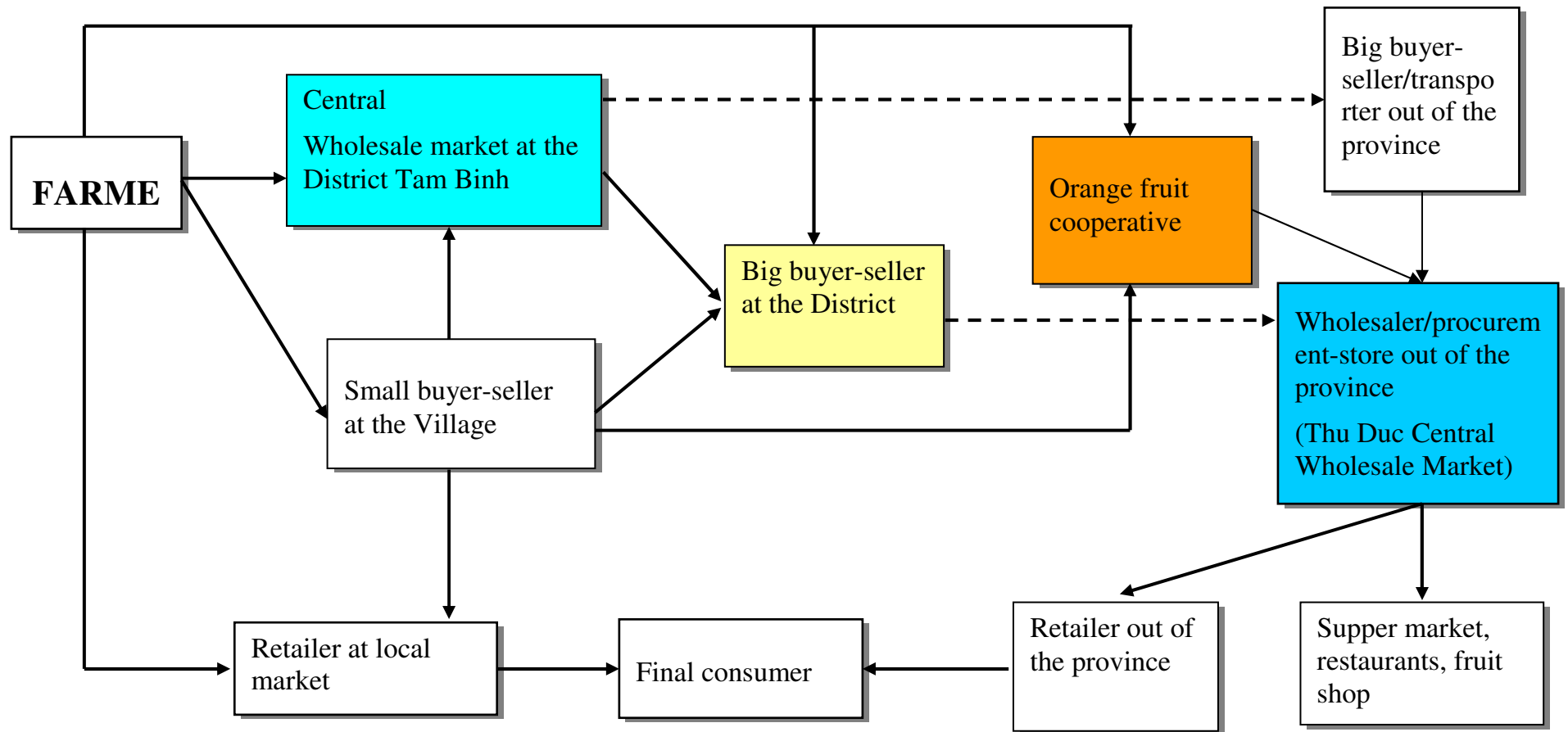
**Figure 3.2** Marketing Channels of Orange

### 3.3. Competition in the Mekong Delta Orange Market

**Degree of product differentiation**

There are two kinds of oranges: "Cam Mat" – Honey Orange and "Cam Sanh" – Citrus Orange, of which Citrus oranges have the higher market price. Honey Orange is generally smaller than Citrus Orange and has a very smooth skin, unlike the skin of the Citrus Orange which is dark green and rough.

Orange farmers usually classify their product into 3 classes:
- 1$^{st}$ class: over 300 grams/piece
- 2$^{nd}$ class: 200 – 300 grams/piece
- 3$^{rd}$ class: lower 200 grams/piece

Based on the maturity level, fresh oranges are classified into two classes: ripe oranges and green oranges. Ripe oranges are sold to HCM City (near the market place) and the green oranges are transported to the northern markets as the quality of a ripe orange will decrease after 3 or 4 days transportation.

Normally, fresh oranges are directly sold on the market without any processing. Fresh orange are packaged in soft boxes (when transferred long distances to Hanoi) or in to baskets (when transferred locally to Ho Chi Minh City).

**Barriers to entry into the market**

Barriers to entry include various problems which prevent entry into the business by a potential rival. In this study, we interviewed orange traders about the different levels of barriers to entry into the orange business. The level of importance of each barriers is then ranked by a grading system.

Various barriers to entry were mentioned by orange traders, these included: lack of working capital, lack of product supply, unstable output market, high taxes, difficulty in getting a business license and severe competition. For orange assemblers, the most important barrier to entry was a lack of working capital (ranked 1$^{st}$, see Table 3.2), but they seemed to have less problems with taxes and business licenses. In the case of orange wholesalers, barriers such as high competition were mentioned. In general, we concluded that – according to the perception of assemblers and wholesalers – there are no strong barriers to entry into the orange industry, other than a lack of access to capital.

**Table 3.2.  Barriers to entry for orange traders**

| Barrier to entry | Ranking important barriers | |
|---|---|---|
| | To assemblers | To wholesalers |
| 1. Lack of working capital | 1 | 2 |
| 2. Lack of product supply | 4 | 5 |
| 3. Unstable output market | 3 | 3 |
| 4. High taxes | 5 | 4 |
| 5. Difficult to get license | - | 6 |
| 6. Severe competition | 2 | 1 |

*Source:     Own survey of 20 traders – 2005.*

**Relationships between different actors in the distribution channel**

After harvest, farmers ship fresh oranges by boat or vehicle directly for sale in central district wholesale markets and/or to buyer-sellers in the village.

Large buyer-sellers/wholesalers in provinces such as HCM City and Hanoi, use the telephone service to connect to suppliers, sometimes, having to make a purchase order in advance. For example, when the demand for fresh oranges increases (during the off-season), wholesalers call the district buyer-seller in order to reserve a certain amount of fresh oranges to purchase.

In the case of local orange assemblers and/or small wholesalers who are near orange farmers, buying and selling is conducted everyday without any appointment. Local assemblers usually have 3-4 regular orange farmers to supply whereas small wholesalers have 2-3 regular buyers and large wholesalers have 4-5 regular buyers.

**Transportation**

Survey results also indicate that fresh oranges are usually transported by small boats or vehicles from the farm-gate to the local market place. Usually, farmers are required to pay this transport cost. The transportation fee by vehicle is around 30,000 VND/ton – (distance 1-2 km).

In the case of large quantities of fresh oranges supplied by large farmers, large buyer-sellers will come to the farm-gate to pick up the product, incurring the transport cost themselves. The transportation fee by boat for 5-10 Km is approximately 50,000 VND/ton

For long-distance transport, large-scale buyers-sellers often use medium sized trucks (5-7 tons capacity) or large boats for transporting their product to other provinces or market places. Transportation costs are 300,000 VND/ton (to HCM City) and 500,000  -700,000 VND/ton (to the northern markets).

**Access to Market Information**

The distribution of market information refers to the availability of relevant market information to farmers and orange traders (wholesalers/retailers). The results of the survey indicate that around 93-95 percent of orange traders and

farmers find it very easy to obtain market information. Few traders complain about the sources of information (See Table 3.3). The results reveal that a lack of access to market information is not a barrier to entry into the market as most of the information related to orange trading is easy to obtain.

**Table 3.3    Access to market information**

| Orange Traders | Percentage of response to different levels (%) | |
|---|---|---|
| | Easy to obtain | Sometimes difficult |
| 1.  Farmer (n=20) | 95.3 | 4.7 |
| 2.  Assembler/wholesaler  (n=20) | 93.2 | 6.8 |

*Source:  Own survey among orange farmers and traders in Vinh Long and Can Tho – 2005*

Sources of market information are described in Table 3.4. Most orange farmers obtain market information from neighbors and relatives (36.5 percent). Others read newspapers, listen to the radio and/or receive information from middlemen. In the case of orange traders, market information is obtained mainly from other traders in the distribution channel (48.2 percent).

**Table 3.4    Sources of Market Information**

| Source of information | Percentage of response to different sources (%) | |
|---|---|---|
| | **Farmers** | **Traders** |
| 1. News paper, radio and TV | 32.0 | 14.2 |
| 2. Information from Central market | 12.3 | 20.5 |
| 3. From private traders or inter-mediaries of the channel | 18.5 | 48.2 |
| 4. From relatives, friends | 36.5 | 16.2 |
| 5. Others | 0.7 | 0.9 |
| Total | 100.0 | 100.0 |

*Source:     Own survey in Vinhlong and Cantho province – 2005.*

*The process of orange price formation*
At the 'farm-gate', business transactions are based on an agreed price. At the central wholesale market, long-distance buyers-sellers and/or wholesalers in other provinces (like HCM City and Hanoi) have strong market power when price setting. The findings of the survey show that most orange suppliers in the district follow prices set by wholesalers at the Thu Duc wholesale market.

**Table 3.5. Output-price formation of orange**

| Price formation | Percentage of response by different orange traders | |
|---|---|---|
| | Farmers (n=20) | Traders (n=20) |
| 1. Buyer | 15.4 | 19.7 |
| 2. Supplier | 15.2 | 13.2 |
| 3. Negotiation between buyer – supplier | 38.5 | 35.9 |
| 4. Based on market price | 30.9 | 31.2 |
| Total | 100.0 | 100.0 |

*Source: Own survey – 2005*

The figures in Table 3.5 indicate that at the 'farm-gate' and wholesale market, the buying and selling price of oranges is usually based on a bargaining process between buyers and sellers and/or based on market price (30 percent to 38 percent of responses respectively).

The process of bargaining in the marketplace usually involves negotiation about price/kg or price/ton of oranges. In the wholesale market, bargaining is more important. Initially, orange suppliers will offer a specific selling price, from there orange buyers are free to bargain and small discounts are accepted. However, in the case of regular clients, in order to save time, orange suppliers usually offer a fixed price and there is no bargaining.

Table 3.6 below presents some specific characteristics that influence the price of oranges in the market. In general, differences in quality and size are the main factors which influence market price. Buying in large or small volumes and distance are not really big problems for orange traders. Survey results show that the maturity level of the oranges also influences the selling price in the market. In summary, product quality and size/weight are mostly taken into account by orange traders price negotiation is conducted.

**Table 3.6 Factors influencing buying and selling prices of orange**

| *Influenced factor* | *Ranking* |
|---|---|
| 1. Differences in quality (by size/weight) | 1 |
| 2. Differences in maturity level | 2 |
| 3. Long or short distance of transport | 3 |
| 4. Buying in large or small volume | 4 |

*Source:    Own survey – 2005*

*Means of payment*

Local buyer-sellers have to pay cash to farmers immediately after purchase. However, long distance buyers-sellers and wholesalers usually use a deferred payment method, paying suppliers one week later. Some large wholesalers also transfer payments to the business.

# 4. PERFORMANCE OF THE ORANGE MARKETING SYSTEM IN THE MEKONG DELTA

In this section, production costs, marketing costs and profits of members are examined. This includes farmers, local orange wholesalers and fruit wholesalers in the Thu Duc Central Wholesale Market as well as retailers outside of the province. In addition, trends in orange prices over time and seasonal variability are also analyzed.

## 4.1. Production costs and profit margins analysis for orange farmers

The orange harvest begins during the fourth year of farming and effective harvest time continues into the tenth year. The costs for the first three years of growing, during the established period, are calculated and depreciated in the cropping year. Costs include land preparation, seedlings/nurseling, fertilizer, irrigation, pesticide, electricity, working equipment and labor. The average cost for growing oranges in the first year is estimated at 33,880,000 VND.

Table 4.1    Average Production Costs – 1$^{st}$ year cultivation of 1 hectare orange

| Cost items | Unit | Amount | Price per unit (dong) | Total cost | % of total |
|---|---|---|---|---|---|
| *Seedling/nurseling* | Unit | 800 | 18,000 | 14,400,000 | 42.50 |
| Land preparation | Man-day | 200 | 30,000 | 6,000,000 | 17.71 |
| Fertilizer<br>- Supper Phosphorus<br>- Organic fertilizer<br>- Powdered Lime | Kg<br>Kg<br>Kg | 400<br>4,000<br>800 | 1,200<br>200<br>1,000 | 480,000<br>800,000<br>800,000 | 1.42<br>2.36<br>2.36 |
| Pesticide | Kg/litre | 10 | 90,000 | 900,000 | 2.66 |
| Irrigation | M$^3$ | 650 | 6,000 | 3,900,000 | 11.51 |
| Equipments/tools | | | | 1,000,000 | 2.95 |
| Labor | Man-day | 200 | 25,000 | 5,000,000 | 14.76 |
| Electricity and fuel | | | | 600,000 | 1.77 |
| Total | | | | 33,880,000 | 100.00 |

*Source:  Department of Agriculture and Rural Development of Vinhlong Province*

In the second and third years, the average costs are estimated to be 13,400,000VND/ha/year. The production costs in these years are lower than the first year as they do not include the cost of seedlings and cost of land preparation. Total costs in the basic established period is 66,600,000 VND/ha.

In the cropping period, costs include fertilizer, pesticide, irrigation, electricity, fuel, harvesting, and labor costs. The average cost per year is 14,750,000VND as shown in the Table 4.2.

**Table 4.2  Average Production Costs – 4<sup>th</sup> year cultivation of 1 hectare orange** *(Period having stable yield capacity)*

| Cost items | Unit | Amount | Price per unit (dong) | Total cost | % of total |
|---|---|---|---|---|---|
| Fertilizer | | | | | |
| - UREA | Kg | 500 | 2,200 | 1,100,000 | 7.46 |
| - Kali | Kg | 500 | 2,000 | 1,000,000 | 6.78 |
| - NPK | Kg | 500 | 2,500 | 1,250,000 | 8.47 |
| - Organic | Kg | 4,000 | 200 | 800,000 | 5.42 |
| Pesticide | Kg/litre | 15 | 90,000 | 1,350,000 | 9.15 |
| Irrigation | $M^3$ | 800 | 6,000 | 4,800,000 | 32.54 |
| Equipments/tools | | | | 100,000 | 0.68 |
| Labor | Man-day | 100 | 25,000 | 2,500,000 | 16.95 |
| Electricity and fuel | | | | 600,000 | 4.07 |
| Harvesting | Man-day | 50 | 25,000 | 1,250,000 | 8.47 |
| Total | | | | 14,750,000 | 100.00 |

*Source:  Department of Agriculture and Rural Development of Vinhlong Province*

Many farmers plant orange trees during to off-season time by applying various different cultivating techniques. Orange yields for off-season crops are lower than seasonable crops, however, they receive a higher price which makes the growing profitable. An evaluation of the costs, income and profits of orange farmers in case of low prices (seasonable crop) , high prices (unseasonable crop) and average prices are shown in the Table 4.3. The results demonstrate that the profit from the off-season crop is twice that of the ordinary crop.

**Table 4.3   Estimated production cost and profit of orange farmers**

| Explanation | Unit | Low price | Average price | High price |
|---|---|---|---|---|
| 1. Production cost during established period * | VND | 8,443,000 | 8,443,000 | 8,443,000 |
| 2. Annual production cost (stable-yield capacity after 3 years) | VND | 14,750,000 | 14,750,000 | 14,750,000 |
| 3. Total cost | VND | **23,407,000** | **23,407,000** | **23,407,000** |
| 4. Average yield capacity/ha ** | Ton | 25 | 15 | 10 |
| 5. Average selling price at farm-gate ** | VND/Ton | 3,000,000 | 6,000,000 | 12,000,000 |
| 6. Total sale | VND | **75,000,000** | **90,000,000** | **120,000,000** |
| 7. Profit margin | VND | **51,593,000** | **66,593,000** | **96,593,000** |

Notes: *   *Production costs during the established period are called cost of depreciation. It is calculated as total production costs from 1$^{st}$ year to 4$^{th}$ year divided by the number of harvesting years (66,600,000 VND/ 7 years = 8,443,000)*

   ** *Yield capacity/ha and selling price are calculated using the weighted average method (data collected from 20 orange farmers).*

Source:    *Survey and estimated by authors*

## 4.2.  Marketing costs and profit margins analysis for district orange wholesalers

Table 4.4 shows the marketing costs of wholesalers as 123.000 VND/ton including labor costs (approx. 60%), packaging (24%) and other costs (6.5% - which includes depreciation on fixed assets, interest on borrowed capital, losses in quality and quantity of products). Overall, the profit of orange wholesalers is 177,000 VND/ton – equivalent to 2.9% of the cost price.

**Table 4.4. Estimated marketing cost of orange wholesalers**

| Prices and Cost items | Marketing cost (VND/Ton) | Percent of total marketing costs (%) |
|---|---|---|
| 1. Average buying price | 6,000,000 | |
| 2. Total marketing costs | 123,000 | 100.0 |
| * Labour costs [1] | 70,000 | 56.9 |
| * Materials for packaging | 30,000 | 24.3 |
| * Fuel, electricity | 5,000 | 4.1 |
| * Taxes, licenses | 10,000 | 8.2 |
| * Others [2] | 8,000 | 6.5 |
| 3. Average selling price | 6,300,000 | |
| 4. Profit margin | 177,000 | |
| 5. Profit as % of cost price | 2.9 | |

Note: [1] Labour costs: payment for permanent and temporary workers and family laborers. This cost was computed based on average man-days that both hired and family workers contributed in 1 month and wages of 1 man-day.

[2] Other costs included the depreciation on fixed assets, interest on borrowed capital, losses in quantity and quality of product.

Average buying price, marketing costs and average selling price are calculated by the weighted average method

Profit margin = Average selling price – (average buying price + total marketing costs)

Source: Own survey 20 orange traders 2005 and estimated by authors

## 4.3. Analysis of marketing costs and profit margins of actors in the orange marketing channel

Table 4.5 gives an overview of the distribution of the marketing margin among actors in the channel. Firstly, we recognize that the profits of orange wholesalers are lower than retailers' profit in both the district central wholesale markets as well as in Thu Duc central wholesale market. District wholesalers have the lowest profit margin ratio (2.9%). However, although the profit margin as percentage of cost price is low, district wholesalers sell fruit on a large scale, about 5 – 7 ton/day, and the return on investment capital is realised very quickly. Thus, they have a reasonable high income.

**Table 4.5    Marketing costs and profit margins of Farmers, District Wholesalers, Central Market Wholesalers and Retailers**

| Cost Items | Cost & Price (VND/Ton) | Gross Marketing Margin | Total Marketing Cost | Profit Margin | |
|---|---|---|---|---|---|
| | | | | Amount | As % of Cost Price |
| **I. Orange Farmers** | | | | | |
| 1. Production cost per ton | 1,560,500 | | | 4,439,500 | 248.5 |
| 2. Average selling price of orange per ton | 6,000,000 | | | | |
| **II. District Wholesalers** | | | | | |
| 1. Average buying price of orange | 6,000,000 | 300,000 | 123,000 | 177,000 | 2.9 |
| 2. Total Marketing Costs | 123,000 | | | | |
| 3. Cost price | 6,123,000 | | | | |
| 4. Average selling price | 6,300,000 | | | | |
| **III. Central Market Wholesalers** | | | | | |
| 1. Average buying price of orange | 6,300,000 | 700,000 | 450,000 | 250,000 | 3.7 |
| 2. Total Marketing Costs | 450,000 | | | | |
| 3. Cost price | 6,750,000 | | | | |
| 4. Average selling price | 7,000,000 | | | | |
| **IV. Retailers** | | | | | |
| 1. Average buying price of orange | 7,000,000 | 1,000,000 | 175,000 | 825,000 | 11.5 |
| 2. Total Marketing Costs | 175,000 | | | | |
| 3. Cost price | 7,175,000 | | | | |
| 4. Average selling price | 8,000,000 | | | | |

*Source: Estimated by own author*

The profit margin as percentage of the cost price of wholesalers in Thu Duc central market is low at 3.7%. However, the level of fruit sales is constantly high (10-12 tons/day) and the return on investment capital is recognised quickly. Subsequently, they actually have the highest income in the channel. In contrast, retailers receive a high profit rate (11%) sales volumes can be quite low, from 150-200 kilos/day. Thus overall, their income is lower in comparison with wholesalers. Farmers have the highest profit rate, but their return on investment capital is very slow. It takes four years of investment before profit is

gained from their harvest. In addition, as there is little land area available for orange cultivation, their income is lower than other groups in the fruit industry.

## 4.4.  Trends in the price of oranges and seasonal fluctuation

The figure 4.1 shows changes in price of first and second class oranges over the ten years from 1990 to 2001. Price depends on many factors such as quantity, time of harvest, markets, consumer income and governmental policies.
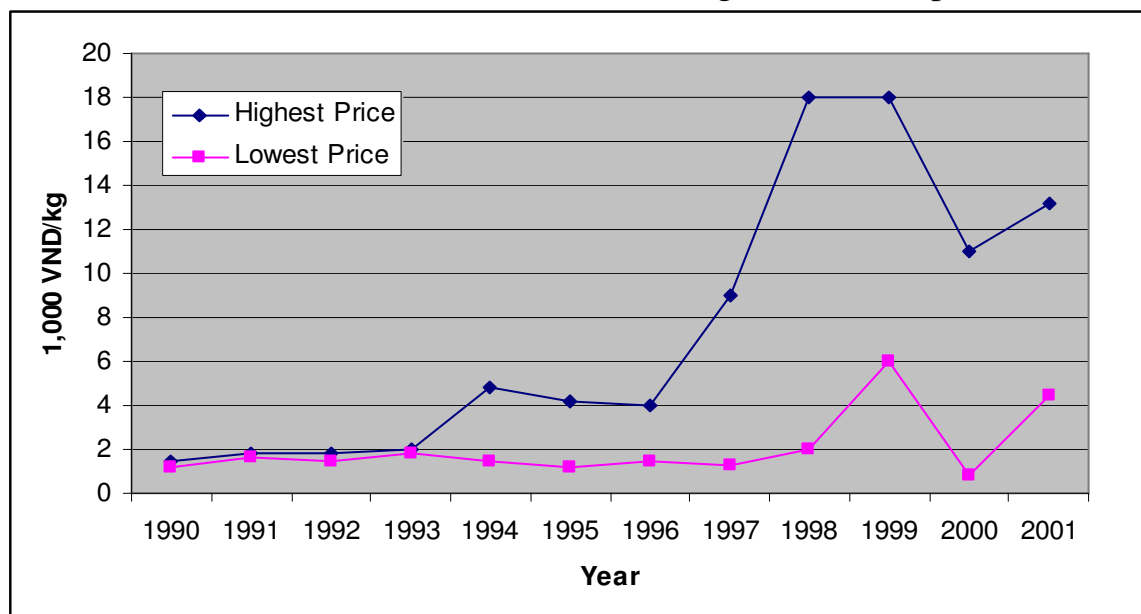


**Figure 4.1.  Trend of orange price fluctuation in the period 1990 -2001**

*Source:  Hai, T.T.B., (2004).*

An increase in the price of oranges encourages investment. However, orange farmers not only rely on nominal prices but also on real prices (price including inflation) and the price of oranges relative to the price of other goods on the market. From 1990 to 1995, there was an annual increase in the index of consumer prices of around 3.2%, meaning that the real price received by farmers decreased. From 1996 to 2001 the consumer price index grew faster around 5.1%/year. The increase in orange prices, particularly during 1996-1998, increased the profits of farmers. However, this was followed by a sharp decrease in prices in 2000 and only a small recovery in 2001. The sustainable development of Vietnam's fruit sector (in particular the Mekong Delta) came under question as farmers began to cut down their plants whenever an unfavorable change in price occurred. Orange prices are also very seasonal with the difference between the highest and lowest price of oranges changing significantly during different periods of the year (Figure 4.2).

Government policies to encourage farmers to grow fruit trees and transfer from mixed cultivation into specialized fruit tree planting promoted a fast expansion of land area for fruit trees. This resulted in a sharp increase in supply, poor

conservation and a decrease in the price of fruit. In contrast, during the offseason, orange prices increased sharply due to low supply. In 2004, the price of oranges reached 12,000 VND/kg (at the highest price) while during the seasonal months price only reached 3,000 VND/kg (at the lowest price).
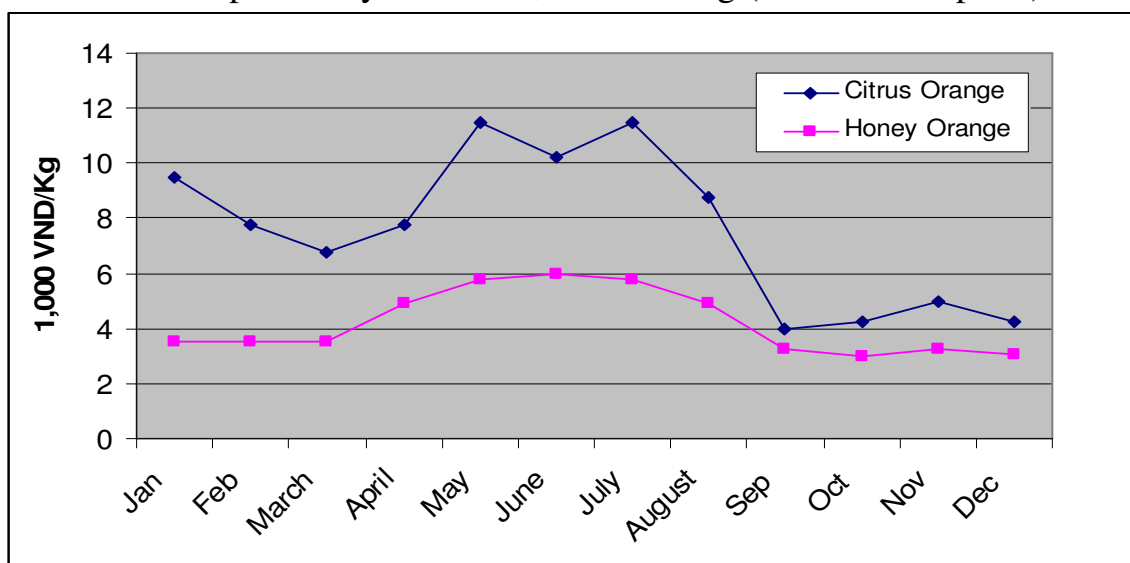


**Figure 4.2   Seasonal orange price in the MRD in 2004**

*Source:   Market Information Office- SOFRI*

# 5.    CONCLUSION AND RECOMMENDATION

(1) Establish large-scale specialized areas of fruit together with an upgrade in the quality of fruit.
Cultivators not only lack necessary skills/techniques but also lack the organisational support required to produce fruits of high quality. Most fruits are sold only on a small scale due to the non-specialisation of most orchards. There are insufficient co-operatives and organizations producing fruit to register a trade mark and trademarks can not be established for households which only produce a few hundred kilograms/tons of fruit, making it difficult to establish a reputation.
Vietnam's farming products, fruits in particular, are inferior as compared with the competition. There are plenty of fruit with a lower quality for eating, but there is little high quality fruit sold at a competitive price. Southern fruits such as Hoa Loc mangoes, Nam Roi grapefruits, Chin Hoa durians, Xuong Com Vang longans which have a lower quality than foreign fruit are also very expensive. Doctor Nguyen Minh Chau states that the volume of high quality fruit is small and inferior as compared to fruit production in Vietnam in general.

200

Fruit tree growing habits need to be changed, high quality fruit trees need to be grown on a large scale. Local government must introduce suitable policies to encourage farmers to implement this change, such as the introduction of new fruit species and policies on land use.

In a market oriented economy, all goods and services should be trademarked in order to assert themselves in the market. Many consumers use trademark as a determinant for choosing and buying goods as the trade mark provides them with information of the origin and the quality of the item. The conference "The Mekong Delta's trade marks" held on 11th and 12th of August, 2005 in Ben Tre, concluded that we should build from the early stages of production. That is, fruit plants of high quality should be cultivated and specialized fruits areas, large enough to grow a highly quality products on a large scale, should be built. According to Doctor Nguyen Minh Chau, the Head of the Southern Institute of Fruits, it is necessary to get farmers involved in co-operatives to produce fruit products with enough volume and quality – and in a close circle – from the inital stages of producing to the final stages of consumption, such that fruit is in accord with the trademark. The government, especially local authorities, should take responsibility for the management of the model of cooperation among the 4 sections (the government, farmers, scientists and business people). They should also provide investment and support so that a fruit trademark of regional strength can be established and developed.

(2) There is an urgent need to establish consultancy services to support fruit channel members, particularly in relation to market information and education on modern farming methods.

The survey results indicate that farmers receive information about the price and quality of fruit from friends and relatives (36.5%). In contrast, traders acquire such information from privative traders or intermediaries (48.2% - see Table 3.4). An information system which gives accurate and timely information about the price and quaility of fruit will help to improve the income of both farmers and traders.

These consultancy centers should also educate farmers about new techniques (particularly in relation to the selection and growing of fruit trees) in order to improve quality and yield. The most influential factor in the price of oranges is quality (size/weight – see Table 3.6). Choosing the correct fruit species to plant and employing suitable farming techniques may improve crops, subsequently farmers and fruit channel members will be able to sell their products for a higher price.

Being a WTO member brings fruits farmers and traders both opportunities and challenges. The more they know about the global market, the better positioned they are for success. Consultancy centers should be established in regions where fruit trees are grown on a large scale.

(3) Support during fruit harvest and storage may also contribute to an increase in the market value of these products.

As analysed above, the price fluctuations between off-season and season months are very high. One of the reasons that the price of orange is very low during the season months is the poor conservation while a sharp increase in supply. Therefore, it is necessary to support during fruit harvest and storage.

**Recommendations for further research**

Based on the above findings, suggestions for further research can be made to help enhance the effectiveness of the fruit marketing channel and to assist the development of the fruit industry in the MRD.

- First, although farmers and other actors are able to access market information, the information is often unreliable and out-of-date. Therefore, it is necessary to conduct further research into building and operating a market information system that helps actors access market information both efficiently and effectively.
- Second, research needs to be conducted in relation to the evaluation of existing orange distribution channels. The exploit of effective and efficient channel should increase the benefit for all actors of marketing system.
- Third, most channel actors belong to the small private sector. Research needs to be conducted into whether these private actors need to be organized into a cooperative sector and whether suitable assistance to improve the strength of these actors should be provided.

# REFERENCES

Bain, J.S. (1968). *Industrial Organization,* 2<sup>nd</sup> Edition, John Wiley, New York.

Batemann, D.I. (1976). *"Agricultural Marketing: A Review of the Literature of Marketing Theory and of Selected Application"*, Journal of Agricultural Economics, Vol.27, pp. 171-224.

Clodius, R.L. and W.F. Mueller (1961). *"Market Structure Analysis as an Orientation of Research in Agricultural Economics"*. Journal of Farm Economics, 43,3, 515-553.

Dijkstra, T. (1997). *"Horticultural Marketing Channels in Kenya: Structure and Development"*. Ph.D. Thesis, Wageningen University, The Netherland. 253p.

Ford, R.H., Roman, F., Murphy, K., Truong, N.H. and Herink, J.V. (2003). *"Strategy for Developing the Fruit Sector"*. Final Report. Project on Enhancing Competitive Capacity in Vietnam - Financed by USAID – USA. J.E. Austin Associate, Inc. Hanoi, May – 2003.

Goossens, F. (1994). *"Performance of Cassava Marketing in Zaire"*. Ph.D. Thesis, Leuven: Catholic University of Leuven.

Hai, T.T.B. (2004). *"Development Orientation for Fruit Processing Sector in Vinhlong Province to the Year 2010"*. Ph.D. Dissertation. Ho Chi Minh, 2004.

Jones, W.O. (1974). *"Regional Analysis and Agricultural Marketing Research in Tropical Africa: Concepts and Experience"*. Stanford Food Research Institute Studies, 13(1), P.3-28.

Lutz, C.H.M. and Tilburg, A. van. (1992). *"Methodology to Evaluate the Performance of Markets in the Food Marketing Channel: With an Application to Periodic Markets in Benin"*. Paper Presented at Workshop on Methods for Agricultural Marketing Research, March 1993. CIP/IARI, New Delhi, India, 24 p.

Luu Thanh Duc Hai. (2003). *The Organization of the Liberalized Rice Market in Vietnam,* Centre for Development Study - Groningen University – The Netherlands, 236 p

Slater, C.C. (1968). *"Marketing Processes in Developing Latin American Societies"*. Journal of Marketing, July, 50-55.

Stern, L.W., Ansary, A.I.E. and Coughlan, A.T. (1996). *Marketing Channels*, 5<sup>th</sup> Edition, Upper Saddle River, NJ: Prentice Hall International.

Tilburg, A. van. (1988). *"Performance Measurement in Respect of Periodic Markets and Marketing Agents Operating at these Markets in Southwest Benin, West-Africa"*. Proceedings of the European Marketing Academy Conference, Bradford (UK), p. 625-646.

Tollens, E. (1992). *"Cassava Marketing in Zaine: An analysis of its Structure, Conduct and Performance",* In L. Cammann (ed.), Traditional Marketing Systems. Feldafing: German Foundation for International Development (DSE), p. 113-127.

T.K.Thi, FAO and MARD, (2000). *"The Competitiveness of Vietnamese Pineapple and Tomatoes".*

# DETERMINANTS OF FARMING HOUSEHOLDS' ACCESS TO FORMAL CREDIT IN THE MEKONG DELTA

**Nguyen Van Ngan**
**Le Khuong Ninh**
**Robert Lensink**

# 1. Introduction

The literature on rural credit markets in developing countries suggests that the structure of the financial system in developing countries differs substantially from that in developed economies (Agénor and Montiel, 1999, p. 189). In developing countries, formal credit markets often do not function well, and consequently access to formal credit is limited, while the informal financial sector flourishes and serves many clients. The main reason is that asymmetric information between formal financiers and those who need financing may lead to adverse selection and moral hazard problems (Stiglitz and Weiss, 1981). Adverse selection and moral hazard may explain why banks ration credit, since a rise in the interest rate may lead to more excessive risk taking by borrowers (moral hazard) and a worsening of the pool of applicants (adverse selection). Before granting a loan, formal lenders usually collect information about the creditworthiness of borrowers. However, due to imperfect markets and asymmetric information, formal lenders are not fully able to evaluate the creditworthiness and loan use of borrowers (Vu, 2001).

The extent of credit rationing may be reduced if borrowers pledge collateral. However, this solution assumes that collateral is available, which is often not the case in developing countries, especially in rural areas. Moreover, even in the case where a borrower is able to put up collateral, he/she may still be credit rationed. The reason behind this is that a lender may be unable to seize the collateral in case of default due to deficiencies in the regulatory system.

If credit rationing is prevalent, farming households may not be able to borrow as much as they wish or may even be denied access to formal credit. Therefore, very often farming households have to rely on informal credit markets to finance their investment (Ray, 1998). The literature on credit markets in developing countries suggests that informal lenders are more able to take advantage of information flows within villages. They clearly know the creditworthiness of borrowers. Due to a close relationship and close distance to the borrowers, informal lenders have better information about the ability of borrowers to repay and how the money is used (Floro et al., 1991). Thus, the cost of collecting information is lower in the informal credit sector and, therefore, informal lenders may have an advantage in lending to small borrowers. However, it is also often argued that informal lenders charge very high interest rates, which increase investment costs if investments are financed by informal credit.

In order to improve access to formal rural credit, in many developing countries governments develop formal financial institutions that lend against relatively low interest rates. This is also the case in Vietnam, the country on which this paper focuses. The formal credit sector in Vietnam is characterized by the

dominance of state-owned commercial banks with a lending share of 73.5 per cent. (World Bank 2002). State-owned commercial banks used to primarily serve the state-owned enterprises, but have recently initiated a credit shift to the private sector, especially SMEs (small to medium enterprises) and households. Especially for rural households, state-owned commercial banks are important providers of rural credit. Well-known examples are the Bank for Agriculture and Rural Development (VBARD), the People's Credit Funds and Rural Shareholding Banks. The VBARD is especially important as it supplied credit to about 33 percent of rural households in 1998 (Dao V.H, 1999). Nevertheless, only a small part of the farming households have access to formal credit (Tran, 1998).

At the macro level, the lack of access to formal credit implies a loss in national output, because productive opportunities are not being utilized by a properly functioning credit market. Also, at the household level a shortage of formal credit may have disastrous effects. Most farming households need formal credit in order to finance necessary production inputs such as land, seeds and fertilizers. In addition, formal credit is important since it may reduce the vulnerability due to illness, drought and crop failures, and it can contribute to a better education, health and housing of the borrower (Ray, 1998). Thus, an increase in access to formal credit is of utmost importance.

There are several empirical papers on credit markets in developing countries that have tried to determine which factors determine a household's access to formal rural credit. This literature shows that in many developing countries trust becomes a very important determinant of access to formal credit since poverty limits the use of collateral. Therefore, credit contracts in rural credit markets often contain personal characteristics, such as education and reputation of farming household heads. In addition, observable characteristics like land size, household income and assets are often important determinants of access to formal credit. However, determinants of access to formal rural credit seem to be country specific, so that generalizations are difficult to make. For this reason, country specific studies on access to formal credit are important.

This paper contributes to the empirical literature on access to formal rural credit in developing countries. The aim is to examine which factors determine access to formal credit of farming households in the Mekong Delta in Vietnam. The analysis is done in two steps. First, we explore why some farming households have access to formal credit, whereas other farming households are denied formal credit. Second, for the group of farming households who do have access to formal rural credit, we examine the determinants of the loan size that can be obtained. The analysis is carried out by estimating a Heckman two step model. A special feature of the paper is that we use a newly developed dataset, based on a survey in 8 communes of 4 districts of 4 provinces in the Mekong Delta region in October 2005. In total, the survey resulted in 240 observations.

The remainder of this paper is organized as follows. Section 2 presents an overall picture of the rural credit market in Vietnam. Section 3 surveys some relevant empirical studies on access to formal credit in Vietnam. Section 4 develops a theoretical framework that will be used to formulate the econometric model. This section also discusses some variables that may be important in explaining access to formal rural credit. Section 5 surveys the data sources used in this study, and presents sampling characteristics. It includes an overview of the sample size, and presents credit characteristics. Section 6 applies the Heckman two-step model to examine the main determinants of the use of formal credit, as well as the main determinants for the size of formal loans. Section 7 summarizes the main results and provides some recommendations for policy makers.

# 2   THE FORMAL CREDIT MARKET IN VIETNAM[13]

This subsection provides an overall picture of the formal financial system in Vietnam. Formal credit institutions are financial intermediaries that operate 'not only to the general laws and regulations but also to specific banking regulation and supervision' (Ledgerwood, 1999). It includes banks, non-bank financial institutions and other credit programs of government and NGOs.

Before 1988, the banking system in Vietnam only comprised the State Bank of Vietnam (SBV) and two specialized institutions, namely the Bank for Investment and Development (BID) and the Bank for Foreign Trade (Vietcombank). The system can be characterized by a state monopoly, and widespread subsidies leading to negative real interest rates. This has led to a bank crash (Putzeys, 2002).

Since 1986 a process of economic reforms, a so-called "*doimoi*", has been implemented in Vietnam. One of the targets of this transformation is to build a strong and efficient financial system that can play an active role in mobilizing and allocating resources. The economic reforms led to a two-level system, consisting of the State Bank of Vietnam and four state-owned commercial banks (SOCBs) that include BID, Vietcombank, the Vietnam Bank for Agriculture and Rural Development (VBARD), and the Bank for Commerce and Industry (BCI). The SOCBs account for more than 70 per cent of the total assets of the whole system. Not surprisingly, SOCBs dominate the credit market with 73.5 per cent of total lending to the economy as of 2002 (World Bank, 2002). The dominance is also mirrored in the mobilization of funds where the SOCBs captured 76 per cent of all resources mobilized through formal institutions. The main customers of SOCBs have been the state-owned enterprises (SOEs) which contribute 75 per cent of the economic output and hold 53 per cent of the banks' loans

---

[13] This section draws heavily from Tra and Lensink (2008).

(*Vietnam Investment Review,* 2003). SOCBs have recently initiated a credit shift to the private sector, especially SMEs (small to medium enterprises) and households. Today, SOCBs are a substantial credit provider for rural Vietnamese households. Among them, the Vietnam bank for Agricultural and Rural Development (VBARD) supplied credit to 33 percent of rural households in 1998 (Dao V.H *et al.*, 1999).

In addition to the SOCBs, there are 36 joint-stock banks (JSBs) in Vietnam. JSBs are supposed to fill the gap in serving the private sector. However, their position appears to be modest. Despite a considerable growth in number, JSBs have been exposed to high competition and high risk due to their inherent nature: low capital base, a small number of branches, inadequate banking services and concentration in two host business centres. With 15 per cent of the lending market, JSBs primarily serve the private sector, particularly local businesses and small enterprises. However, rapid loan growth and weak capacity to assess credit risk could result in non-performing loan problems, and JSBs may not have adequate access to external sources of recapitalization.

The formal financial sector in Vietnam also contains branches of 27 Foreign Banks. However, foreign banks in Vietnam are far from becoming fully fledged participants on the Vietnamese financial sector due to the current regulatory structures and costly acquisition of information. As a result, they are mainly engaged in lending to foreign-owned enterprises. There are also are also some financial institutions in Vietnam that provide subsidized credit. The most important example of this group is the Vietnam bank for the Poor (VBP), currently known as the Vietnam Bank for Social Policy. This bank was established in 1995. The VBP mainly focuses on poverty alleviation. By 2002, the VBP has offered credit to the poor at a substantial outreach, totalling to US$452 million in credit to some 2.7 million households (World Bank 2002). In March 2003, VBP has been recognized as a new policy bank, Vietnam Bank for Social Policy (VBSP). In addition, there are some credit cooperatives, various national development programmes, such as the poverty alleviation programme and the job creation programme, and some savings and credit schemes supported by NGOs and foreign donors. Finally, there are four joint-venture banks, nine financial-lease companies, and a few securities and insurance companies. However, these financial institutions play a minor role. That also holds for the only stock exchange in Vietnam, which was established in 2000 in Ho Chi Minh City.

Despite the long list of formal financial institutions in Vietnam, it appears that many households fail to gain access to formal credit. Very often formal financial institutions maintain awkward and time-consuming procedures, creating high transaction costs in household lending (Le K. N., 2003). Consequently, many households have little incentive to pursue formal credit (McCarty, 2001).

## 3. FARMING HOUSEHOLD'S ACCESS TO FORMAL CREDIT IN VIETNAM: A SURVEY

The formal financial sector appears to be inadequate in fulfilling the credit needs of Vietnamese households. Some households have access to formal credit, while others are denied formal credit. By reviewing the existing literature on access to formal credit in Vietnam, this section aims to provide a first indication about the main determinants that explain access for formal credit.

The strategy of almost all empirical studies on the determinants of access to formal credit is similar. First, a proxy for households' access to formal credit is identified. Mostly, a binary variable is constructed. Second, the determinants of households' access to formal credit are examined by estimating a Probit or a Logit model. Finally, for those households that have access to formal credit, it is examined which determinants can explain the size of the formal loan. Mostly, an Ordinary Least Square (OLS) regression model or a Tobit model is used. In some cases, the determinants of the size of the formal loan and the probability of access to formal loans is estimated simultaneously by a two step regression model, such as the Heckman model.

Tran (1998) uses a Logit model and Ordinary Least Square (OLS) regressions to examine determinants of households' access to formal credit in Vietnam. His study shows that farm size, farm size squared, total number of household members, number of dependents, the possibility of pledging collateral, and social participation have a significant impact on the probability of access to formal credit. The same set of variables explains the size of the formal loan. Vu (2001) examines access to formal credit in the Red River Delta region in Vietnam. Her study suggests that land size and social position are especially important in explaining access to formal credit. Pham and Izumida (2002) study determinants of access to formal rural credit in Vietnam. They point at the importance of the size of the farming area, the age of the household head, the education of household head, total production value of livestock, number of adults, and the number of dependants. Quach, Mullineux and Murinde (2005) apply a Heckman two-step model to examine the impact of rural credit on household poverty in Vietnam. They also examine the determinants of access to formal credit. Their study points at the importance of the ability to get informal funds, financial and non-financial savings, household size, and land size. Tra and Lensink (2007) compare lending policies of formal, informal and semi-formal lenders with respect to household lending in Vietnam. Their analysis suggests that the probability of access to formal credit increases if borrowers provide collateral, a guarantor and/ or borrow for business related activities. It also appears that the probability of access to formal credit increases in household welfare up to a certain threshold, but at a decreasing rate.

Although results differ somewhat for the above mentioned studies, a clear picture emerges. The probability of access to formal credit appears to depend on

borrower characteristics, such as age, income, education, social position in the village, and the possibility of pledging collateral. In the remainder of this paper, we will examine whether the same holds for access to formal credit in the Mekong River Delta in Vietnam.


# 4.   DATA DESCRIPTION

The section explains the data selection and provides a descriptive analysis of the main variables. Since no secondary data is available, a survey has been done in the rural Mekong Delta in October 2005. The sample includes 240 farming households spreading over four provinces in the Mekong Delta, *i.e.* Tien Giang, Dong Thap, Can Tho and Soc Trang. In each province, we selected one rural district and then chose two communes randomly. The data contain information on households' characteristics, loan characteristics, credit behavior of borrowers and so on. These data will be used to analyze the determinants of farm household's access to formal credit.

The households in the sample were selected randomly and interviewed. The survey was conducted with the help of twelve final-year economic students at Can Tho University. Interviews were directly conducted at the site of households in the survey region.

The surveyed sample has some strengths and weaknesses. Strengths of this sample are the size of the sample and the reliability of information collected. One weakness is that data were collected from farming households that are relatively easy to reach. It does not include remote areas, so that the data may suffer from some selection bias.

We also used data from the World Bank, VBARD annual reports, VLSS and other studies to describe credit activities in rural Vietnam. These data provide information about the rural financial market, the main credit suppliers, and the financial system in Vietnam. Table 1 provides information about the relative number of borrowers that obtained credit. It shows that from the 240 farm households that were interviewed, there are 124 households that had access to formal credit; accounting for 51.67 percent of the total number of households in the sample.

**Table 1:    Borrowing Statistics**

| Borrowed | Frequencies | Percentages |
|----------|-------------|-------------|
| No | 116 | 48.33 |
| Yes | 124 | 51.67 |
| Total | 240 | 100.00 |

*Source: Own calculation from the survey data, 2005.*

Some additional information about the sample is given in Table 2 and Table 3. Table 2 shows the distribution of loans from different financial institutions. Most loans come from VBARD. The Nhon Ai bank is the least important in terms of the amount of loans.

**Table 2:    Statistic of borrowed farming households by institutions**

| Formal institutions | Frequencies | Percentages |
|---------------------|-------------|-------------|
| VBARD | 78 | 65.00 |
| VBSP | 17 | 14.17 |
| Women's Union | 8 | 6.66 |
| Sacombank | 6 | 5.00 |
| Housing development bank | 5 | 4.17 |
| Credit cooperatives | 4 | 3.33 |
| Nhon Ai bank | 2 | 1.67 |
| **Total** | **124** | **100.00** |

*Source: Own calculation from the survey data, 2005.*

Table 3 shows that the average formal loan size is about VND 14.8 million. The largest loan size comes from the Sacombank, VND 36.67 million on average. The smallest loan is from the Women's union, on average VND 2.52 million. It appears that most farming households that borrowed from formal sectors are rich or are large. Moreover, they were able to pledge collateral. The table also shows that interest rates differ. While VBSP and Women's Union have a low average interest rate of approximately 0.7 percent, other formal institutions have an interest rate just greater than 1 percent. This may be explained by the fact that the Vietnamese government has followed the traditional approach to establish a formal financial system in rural credit markets; it advocates cheap

credit to support farm households and agricultural production, formal institutions provide loans with low interest rates. Before 2002, the State Bank of Vietnam had imposed a ceiling interest rate that resulted in low interest rates.

Table 3 also shows that average transaction costs are about VND 45,630. These costs refer to cost of taking out a loan. It includes transportation costs, costs of providing necessary documents to obtain the loan and costs incurred in the collateral procedure. Other costs incurred when applying for a loan such as time lost and opportunity cost are not included in transaction cost because they cannot be measured accurately. Farming households who take loans from the Women's Union face the lowest transaction cost whereas the largest costs are occured from the Housing Development Bank.

**Table 3:    Statistic of some credit characteristics (averages)**

| Formal institutions | Loan size (million VND) | Interest (percent per month) | Cost of taking loan per time (thousand VND) | Repayment duration (months) |
|---|---|---|---|---|
| VBARD | 14.94 | 1.07 | 52.79 | 20 |
| VBSP | 9.21 | 0.70 | 28.33 | 21 |
| Women's Union | 2.52 | 0.78 | 5.00 | 12 |
| Sacombank | 36.67 | 1.06 | 16.67 | 32 |
| Housing development bank | 23.40 | 1.06 | 60.00 | 39 |
| Credit cooperatives | 13.75 | 1.05 | 30.00 | 27 |
| Nhon Ai bank | 22.50 | 1.05 | 50.00 | 12 |
| **Total** | **14.80** | **1.00** | **45.63** | **20.95** |

*Source: Own calculation from the survey data, 2005.*

The survey indicated that the average repayment period in the formal sector is about 21 months. Farming households take credit from formal institutions to finance their production such as rice growing, orchard planting or feeding livestock. (The repayment period varies between 12 months and 39 months.)

Table 4 indicates that the average formal loan size (forloan) is VND 14.8 million. A positive skewness value means the formal loan size obtained by farming households is generally small. The sample includes 116 farming households that did not borrow, leading to a kurtosis of 37.

Table 4 also shows that in the survey area, the average land size of a household (land) is 8.96 thousands square meters. The land size of households varies largely across farming households because its standard deviation is relatively large as compared to its mean. A positive skewness of 2.98 and kurtosis of

14.44 means that the size of household land distribution has a long right tail: many farming households had small land size in October 2005.

The average farming household income (income), age of farming household head (age), education of farming household head (education) variables also have positive skewness and great values of kurtosis meaning that distributions of these variables also have long right tails: many farming households have small values of these variables.

**Table 4:    Descriptive statistics of variables**

| Variables | Mean | Std. Dev. | Skewness | Kurtosis |
|-----------|------|-----------|----------|----------|
| Formal | 0.52 | 0.50 | -0.07 | 1.01 |
| Forloan | 14.80 | 21.08 | 5.13 | 37 |
| Red | 0.88 | 0.33 | -2.33 | 6.41 |
| Age | 51 | 13 | 0.25 | 2.76 |
| Sex | 0.83 | 0.38 | -1.75 | 4.06 |
| Income | 45.41 | 60.23 | 6.39 | 63.69 |
| Social | 0.33 | 0.47 | 0.75 | 1.56 |
| Informal | 0.27 | 0.45 | 1.03 | 2.06 |
| Reason | 0.76 | 0.43 | -1.21 | 2.45 |
| Land | 8.96 | 9.77 | 2.98 | 14.44 |
| Education | 6.13 | 3.24 | 0.43 | 2.58 |
| Collateral | 0.38 | 0.49 | 0.50 | 1.25 |

*Source: Statistic from the survey data, 2005.*

Table 4 also indicates that 52 percent of farming households borrowed from the formal sector (formal) and only 27 percent of farming households borrowed from the informal sector (informal). 38 percent of farming household submitted collateral when they took loans (collateral). Household heads that have social or political positions (social) in local authority account for 33 percent of total number of household heads in the survey sample, 83 percent of farming household heads are male, 76 percent of farming households applied to get formal loan (reason) for the purpose of production and 88 percent of households have "Red" certificates of land use rights.

# 4. THE ESTIMATION METHODOLOGY AND THE INDEPENDENT VARIABLES

There are two dependent variables in this study: a binary dummy for access to formal credit by farm households and a continuous variable for the loan amount per household. The dummy variable is named *formal*. It takes a value equal to one if a farming household uses a formal loan and zero otherwise. We use a Heckman two-step model to examine the determinants of access to credit and the loan size. The Heckman selection model provides consistent, asymptotically efficient estimates for all parameters in the model.

The Heckman model uses, in the first step, a Probit model to examine which variables positively affect the probability of using formal credit by farming households. The Heckman model also estimates the determinants of the size of the loan, by applying an Ordinary Least Square (OLS) regression model in a second step.

The vector of explanatory variables in the first step includes age, sex, social or political positions of the farming household head, a dummy variable indicating whether a farming household has a loan from the informal sector, and a dummy variable indicating whether a household has a certificate of land use right. The vector of explanatory variables in the second step includes loan purpose, total income of the farming household, a dummy variable indicating whether collateral is pledged, land size of the farming household, and education of the farming household head.

Table 5 provides information on the expected sign of the independent variables in the two steps.

**Table 5: Summary of variables with expected signs considering in models**

| Variables | Abbreviation | Expected sign | |
|---|---|---|---|
| | | (1) | (2) |
| Household with "red" certification of land use right | Red | + | |
| Age of farming household head | Age | +/- | |
| Sex of farming household head | Sex | +/- | |
| Total income of farming household | Income | | -/+ |
| Social or political of household head | Social | + | |
| Land size of farming household | Land | | + |
| Education of farming household head | Education | | -/+ |
| Farming household having loan from informal source | Informal | - | |
| Purpose when farming household apply to obtain formal loan | Reason | | -/+ |
| Farming households mortgage collateral when they borrow | Collateral | | + |

*Note: (1) refers to the first step in the Heckman model;*
*(2) refers to the second step in the Heckman model*

The independent variables are defined as follows:

**Collateral** is a dummy variable that indicates whether a farming household does or does not pledge collateral when applying for a loan. This variable takes a value of one if a farming household borrowed with collateral; it is zero if it did not.

**Income** is the average annual income of the farming household. If the income of a farming household is high, the demand for credit may be low since they have enough money to support their expenditures. This variable is measured in VND million (Pham and Izumida, 2002).

**Age** measures the age of the farming household head. Older households control more resources, have more experience, better reputation, and responsibility. Therefore they are more likely to use formal credit (Nguyen, 2003).

**Sex** is sex of farming household head. This is a dummy variable. The variable takes a value one if the farm household head is male and zero if the farm household head is a female. Males tends to borrow from formal sector while females favor to take loans from informal sources (Tran, 1998).

**Land** is the size of the land owned by the farming household. Land owned by a farming household in the survey region includes cropland, garden land, house building land and other land. It can be used as collateral for formal credit. This independent variable is measured per thousand square meters (Tran, 1998; Le, 2002).

**Social** is a dummy independent variable that represents the social or political status of the farming household head. This variable can be understood that farming household heads have social or political positions in the local authority such as village leaders, commune leaders, leaders of Women's unions, Farmers' associations, etc. This variable takes a value of one if farming household head holds a social or political position in the local authority; it is zero if they do not (Tran, 1998).

**Red** is "Red" certificate of the land use rights. This is a dummy independent variable. It receives zero value if farming household has no "Red" certificate; and one if the farming household has a certificate. Formal lenders require farm household to pledge their land use rights when borrowing. Even if farming households do not provide collateral, they have to give "Red" certificate as a guarantee. The hypothesis is that if a farming household has "Red" certificate, they tend to gain access to formal credit.

**Education** is education level of the farming household head. This independent variable is measured by the number of the school years undertaken by the farming household head. Faming households with higher education levels will prefer to gain credit in the formal sector (Nguyen, 2001).

**Reason** is purpose for which the farming household applies for the formal loan. It is a dummy variable. This variable takes a value of one if a farming

household applied to the formal sector for production expense purposes; it is zero if they applied for non-production expenses.

**Informal** is a dummy variable. It represents whether the farming household does or does not have a loan from an informal source when they applied. This variable takes a value of one if a farming household has borrowed from the informal sector and zero if they have not.

Through the above-mentioned justification of the independent variables, it is reasonable to consider these variables in following Heckman two-steps model. Expected signs of these explanatory variables are summarized in the following table.

# 6.    EMPIRICAL RESULTS

The results of the Heckman two-step model are presented in Table 6. The Wald ratio test rejects the null hypothesis that all slope coefficients are equal to zero. It indicates that the goodness-of-fit of this model is high.

There are 4 parameters that are statistically significant at the 10 or 5 percent significance level. The age of the farming household head has a significant impact on the probability of access to formal credit at the 10 percent significance level. The regression indicates that older farming households often have more assets, reputation, and fullfill the requirement for getting from the formal credit. In contrast, younger farming households often lack capital and other conditions as compared with older households. However, as they are active, adapt to new agricultural production technology easily and have high demand for credit. Formal lenders consider young farming households as having a high production capacity and prefer to lend to them.

**Table 6: Results of Heckman two-steps model**

|  | Coefficients | t - value | P value |
|---|---|---|---|
| **Forloan (second step)** | | | |
| Reason | - 14,351 | -3.17 | 0.001 |
| Collateral | 21,873 | 4.84 | 0.000 |
| Income | 0.0826 | 0.82 | 0.416 |
| Land | 198 | 2.90 | 0.004 |
| Education | 1,403 | 2.38 | 0.014 |
| _cons | 6,655 | 0.80 | 0.357 |
| **Formal (first step)** | | | |
| Age | -0.0124 | -1.79 | 0.085 |
| Sex | 0.6282 | 2.55 | 0.012 |
| Social | 0.2764 | 1.43 | 0.145 |
| Red | 0.7726 | -5.70 | 0.010 |
| Informal | -0.9137 | 2.49 | 0.000 |
| _cons | -0.3198 | -0.57 | 0.508 |
| Number of observations | | | 240 |
| Number of positive observations | | | 124 |
| Wald $\chi^2$ | | | 98.84 |
| Probability greater than $\chi^2$ (F-test) | | | 0.0000 |

*Note: Significant at the 10 percent level if P value is smaller than or equal to 0.1*
*Significant at the 5 percent level if P value is smaller than or equal to 0.05*

However, having a sign opposite to what was expected, the sex of the household head is also statistically significant at the 5 percent significant level in the selection model. Theory supports the fact that a male household head would prefer to borrow from a formal source of credit and a female household head prefers the informal sector. Data processing results seem to advocate this argument. In the formal market, a male household head tends to get more credit as compared to a female household head.

The estimated parameter of the *Social* variable is not statistically significant in the selection model. It implies that the formal lenders do not favour farming households that have influence or responsibility in the commune.

*A Red* certificate of land use rights has a significant impact on the probability of gaining access to formal credit at the 5 percent significance level. Formal lenders consider certificates of land use rights as collateral, although in many cases farming households do not mortgage it. However, to obtain a formal loan,

farming households must pledge the certificate with the bank. So if farming households have *Red*, they tend to be favored in gaining access to formal credit. Results from the selection model support that if a household has a certificate of land use rights, the probability of gaining formal credit increases.

The *informal* variable has a negative significant effect on the selection model at the 1 percent significance level. Theory argues that if farming households do not obtain a formal loan, they must borrow from the informal sector. Therefore, if farming households realize that they do not meet all the conditions to gain access to formal credit, they will apply to obtain informal credit instead. Thus the probability of gaining formal credit decreases.

As shown in Table 6, there are 4 significant estimated coefficients in the regression model. This means the formal loan size that farming households receive is dependant on *reason, collateral, land* and *education* variables. The effect of each independent variable will be explained step by step.

The *Reason* variable has a significant negative effect on the formal loan size at the 1 percent significance level. This means that formal lenders give smaller loans for farming households if they apply for a formal loan for the purpose of production. In the surveyed region, farming households often apply for large formal loans when they need credit for non-production purposes such as the building of houses, purchasing agricultural machinery, etc.

*Collateral* has a very significant impact on the formal loan size at the 1 percent significance level. The formal lenders require farming households to submit collateral to reduce the risk level when they borrow more than 10 million VND. In rural areas, farming households use the certificate of the land use rights as collateral with the formal lenders when they apply for large formal loans.

The coefficient on the average farming household income variable is not significantly different from zero in the regression model. A review of existing literature suggests that farming households with higher income will demand less credit because they are capable of financing their own expenditure. However, the regression model shows that formal lenders do not base loan size on household income.

The estimated coefficient of the land size variable is expected to have a positive sign. This variable is significant at the 1 percent significant level. Land size characterizes a household's ability to widen production and consequently increases the demand for credit. That is, if a farming household has a larger land size, it will need more capital to expand production or transform production structure thus will have a higher demand for formal credit. From the viewpoint of formal lenders, large land size is also considered collateral and hence they will lend more to households with larger land size.

Farming households where the head of the household has a high level of education are considered better at business and consequently are more likely to receive a larger return on their investment in production. This is because with a

higher education level, farming households are likely to be more capable of business planning.

# 7.    CONCLUSION AND RECOMMENDATIONS

This paper represents the determinants of farming household's access to formal credit in the Mekong Delta, Vietnam. The results of the Heckman two-step model illustrate that the variables, called *age, sex, red, informal,* are significant in explaning the probability of a farming household gaining access to credit in the formal market. Additional to this, there are four variables that have significant impacts on the size of the loan that farming households are offered from the formal institutions. These are *reason, collateral, land* and *education* variables.

Recently, it has been recognised that households along with private enterprises are important contributors to the social-economic development of rural Vietnam. A significant factor in the wellbeing of households is the provision of credit as a lack of capital can be a major obstacle to rural development.

Findings in section 5 show that there are some independent variables that have a significant impact on a farming household's access to credit. The decision to borrow or to lend depends heavily on a household's characteristics. From these results we can make some recommendations about factors that may improve a farming household's access to credit.

The first recommendation is that the process of granting land titles needs to be completed. Most farming households are peasant households with a relatively large land area. However, twelve percent of households interviewed were considered as lacking collateral in the banks' perception as they did not hold title over the land. The results of the regression analysis have shown that land title has a positive and significant effect on the probability for farming households' access to formal credit. Thus, in order to increase farming households' access to formal credit, the government should issue policies to speed up and complete the land title granting process.

The second recommendation is based on the finding that banks mainly lend to farming households with large land size. Banks consider "red" certificates as collateral, however, when they evaluate collateral in order to decide how much to lend, the value of the land is undervalued due to government regulated land price being much lower than market price. Consequently, only a small loan is granted. If the formal lenders acknowldeged the market price of land, farming households' access to formal credit may be increased.

The third policy implication is an improvement in the education of the heads of farming households. The positive relationship between education levels and access to bank credit implies that improved education levels would make it easier for farming households to access to bank credit.

These are only some of the possible solutions to problems associated with farming households accessing formal credit. However, it is hoped that if these recommendations are followed it may inturn create a better lending environment with farmering households' gaining greater access to credit. Further studies may extend this research to the informal credit sector in the Mekong Delta region.

# REFERENCES

De Vaus, D.A (1995) (ed) *Survey on Social Research*. Sydney: Allen & Unwin Donald, 1976.

Floro, S.L. and P.A. Yotopoulos (1991) *Informal Credit Markets and the New Institutional Economics: The Case of Philippine Agriculture* Boulder: Westview Press.

Gujarati, D.M. (1995), *Basic Econometrics,* third edition. McGraw-Hill International Edition.

Hamilton, L.C. (1998) *Statistics with Stata 5* London: Duxbury Press.

Le, Khuong Ninh (2003) *Investment of Rice Mills in Vietnam: The Role of Financial Market Imperfections and Uncertainty.* Centre for Development Studies, University of Groningen, the Netherlands.

Le, Nhat Hanh (2002) *An Analysis of Access to Formal Credit by Household Farms: The Case of Vietnam*. Master thesis, Vietnam – Netherlands Project, Hochiminh city.

Ledgerwood, J. (1999) *Microfinance Handbook: An Institutional and Financial Perspective* Washington, D.C.: The World Bank.

Manson, R.D., D.A. Lind and W.G. Marchal (1999) *Statistical Techniques in Business and Economics*, tenth edition. London: the MacGraw-Hill International Edition.

McCarty, A. (2001) *Microfinace in Vietnam: A Survey of Schemes and Issues*, Final Report for DFID (The British Department of International Development) and The State Bank of Vietnam.

Moll, H.A.J., R. Ruben, E.W.G. Mol and A.A. Sanders (2000) 'Exploring Segmentation In Rural Financial Markets: An Application In El Salvador' in *Saving and Development*, Vol. 24 no.1 (2000).

Nguyen, Manh Ha (2001) *Effect of Farmer's Education on Household's Access to Formal Credit: A Case of Vietnam Rural*, M.A thesis, Master thesis, The Vietnam-Netherlands Project, Ho Chi Minh City.

Nguyen, Van Ngan (2003) *Effects of the value of assets on farming households' access to credit in rural Vietnam: the case of Chau Thanh A district, Can Tho province,* M.A thesis, Master thesis, The Vietnam-Netherlands Project, Ho Chi Minh City.

Nguyen, Thi Thanh Huong (2002) *An Analysis of Informal versus Formal Microfinance Activities of the Rural Poor in Vietnam*, Master thesis, The Vietnam-Netherlands Project, Ha Noi.

Pham, Bao Duong. and Y. Izumida (2002) 'Rural Development Finance in Vietnam: A Microeconomtric Analysis of Household Surveys', *World Development* Vol.30, no.2 pp: 319-35.

Putzeys, R. (2002) "Microfinance in Vietnam: Three Case Studies". Preparation MSc thesis of Development Cooperation, University of Gent, Belgium, The Belgian Technical Cooperation of Hanoi, Vietnam.

Quach, Manh Hao (2005) "Rural Credit and Household Poverty in Vietnam". Paper preparing for the conference on microfinance to be held at the University of Groningen, July 1-2, 2005.

Ray, D. (1998) *Development Economics*. New Jersey: Princeton University Press.

Stiglitz, J.E. and K. Hoff (1993) 'Imperfect Information and Rural Credit Markets: Puzzles and Policy Perspective' in K. Hoff, A. Braverman and J.E. Stiglitz (1993) *The Economics of Rural Organization: Theory, Practice and Policy* Oxford: Oxford University Press, pp 33-52.

Tra, Pham Thi Thu and Robert Lensink (2007). "Lending Policies of Informal, Informal and Semi-Formal Lenders: Evidence from Vietnam", *Economics of Transition*. Forthcoming.

Tra, Pham Thi Thu and Robert Lensink (2008). "Household Borrowing in Vietnam: A Comparative Study of Default Risks of Formal, Informal and Semi-Formal Credit", *Journal of Emerging Markets Finance*. Forthcoming.

Tran, Tho Dat (1998) 'Borrower Transactions Costs and Credit Rationing: A Study of the Rural Credit Market in Vietnam', paper prepared for the conference 'Vietnam and the Region: Asia-Pacific Experiences and Vietnam's Economic Policy Directions', Hanoi: April 20-21, 1998

UNDP (1999) *The Institutional and Legal Structure of Microfinance in Vietnam*, Hanoi

Vu, Thi Thanh Ha (2001) *Determinants of Rural Households' Borrowing from the Formal Financial Sector: A study of the rural credit market in Red river delta region.* Master thesis, Vietnam – Netherlands Project, Hanoi.

# A Comparative Study of "Three Reductions Three Gains" and Popular Rice Production Models in the Mekong Delta

**Vo Thi Lang**
**Ngo Thi Thanh Truc**
**Huynh Thi Dan Xuan**
**Mai Van Nam**

# 1. INTRODUCTION

In the last three decades, Vietnam rice production has increased continuously from 11.6 million tons in 1975 to 35.6 million tons in 2004. The cultivation area has also increased from 5.6 to 7.3 million hectares with average yields from 2.2 to 4.9 tons/ha (Xuan, 2005). This increase in rice quantity has turned Vietnam into one of the largest rice exporting nations in the world. The Mekong Delta (MD) has played a major role in this achievement. Intensive farming patterns (two to three paddy crops per year) have replaced the traditional farming style (one paddy crop per year). When the planted area increases, input quantity also increases. Seeds, inorganic fertilizers and pesticides are the main material inputs in rice production. These inputs are necessary for rice production in Vietnam, and can thereby be used to improve farmers' living conditions as well as increasing the quantity of rice exported from Vietnam, particularly from the MD.

Intensive farming has greatly affected the environment and human health, particularly through the use of agrochemicals by farmers to push up paddy productivity. At present, MD farmers rely solely on chemical fertilizers and plant protection chemicals. They believe that these inputs help raise paddy yield per hectare, thereby increasing paddy production and consequently profit. In order to increase their paddy yield, farmers are using quantities of chemical fertilizers beyond what is required. This not only results in wastage, but also results in an increase in pests. If there are more pests, they need more pesticides. These actions push up production costs and reduce profits. In addition, increased pesticide use threatens the health of pesticide applicators, society and the ecology.

In the MD, average inorganic fertilizers used per hectare increased from 40kg during 1976-1981 to 120kg during the period 1987-1988 and again to 140 kg in 1992. This figure has continued to increase in recent years. Survey data from HCM City's University of Economics and experimental data from the Cuulong Delta Rice Research Institute (collected from 1996 till present) shows that rice farmers used an average pure nitrogen, phosphorus, potassium (N,P,K) rate of 180-190 kg/ha. This mix of N, P and K is not rational. The overuse of nitrogen fertilizer is an outstanding feature in fertilization practices of rice farmers today (Dung, 2000).

According to a 1997 survey by Dung, MD farmers used 75 kinds of pesticides, of which there were 28 kinds of insecticides, 17 herbicides and 30 fungicides. On average, each farmer used 1017 grams of active ingredient (a.i.) per hectare for the winter-spring crop. Of the 1017 grams, insecticides made up 43% (most of which belonged to groups I and II, which have high and moderate toxicity according to the World Health Organization (WHO) classification).

There have been several previous studies focusing on the impact of agrochemical use on productivity, human health and the natural environment in the MD. These studies have shared a common finding: pesticide use has bad effects on farmer health and on the environment – particularly on water resources (Dung, 1997; Phuong, 2003). These external costs are not included in the production costs of farmers.

The externalities arising from the use of excess nitrogen and pesticides on plants can be seen through the deteriorated health of sprayers, health damage and even death of consumers, contaminated freshwater surface and groundwater sources, reduced quantities of useful organisms, etc.

In 2002, in order to raise economic efficiency in rice production and to reduce the detrimental impact of using agrochemicals, a program called "Three Reductions Three Gains" (3R3G) (previously "Integrated Crop Management" (ICM) ) was developed in some provinces in the MD. The term "3 Reductions" means reducing the three input factors (seeds, inorganic fertilizers, and pesticides) and "3 Gains" refers to obtaining three higher output results (yield, rice quality, and profits). In addition to technical content – which is derived from the theories and practices of universal techniques such as high-quality seed, high-yield rice farming technique, the IPM method – 3R3G includes knowledge transfer to rice farmers using methods such as multimedia techniques and farmers' participatory approach through demonstration activities. The program has been carried out in the MD by the local authorities with the help of the Plant Protection Department, the International Rice Research Institute (IRRI) and the Cuu Long Delta Rice Research Institute.

The 3R3G program began after the Plant Protection Department investigated the paddy farming practices of 600 farming households in O Mon and Vi Thuy districts of old Cantho province in 2000. The results showed that many farmers did not follow the recommendations of the Cuu long Delta Rice Research Institute when they applied fertilizers and pesticides in their paddy production. This caused nutrient imbalance in the soil thereby affecting paddy productivity. The practices of farmers neither increased efficiency nor protected the environment. The Plant Protection Department proposed the 3R3G program to help farmers reduce production costs as well as to increase rice quality and income. From the 2002-2003 winter-spring crop to 2003-2004 crop, some 82.000 households in O Mon and Vi Thuy districts were distributed instructional documents to carry out the program on an area of nearly 50.000 hectares. After a period of time long enough for results could be gathered, the Plant Protection Department joined force with local government units to disseminate the program to other provinces in the MD. According to the assessment of the MD Services of Agriculture and Rural Development and the Plant Protection Department, the 3R3G area currently covers 418.481 ha or 15% of the 2004 planted area. Almost all of the MD provinces have more or less applied this model in paddy production.

The clear aim of the 3R3G program when it was initially initiated by the Ministry of Agriculture and Rural Development was to change rice-farming practices in the MD in order to cut costs, raise rice quality, increase farmers' income and protect farmer health and the environment. However, when local authorities in the MD analyzed 3R3G program results, they focused solely on economic results and paid little attention to the environmental aspects. In addition, the 3R3G program has not been extensively implemented and accepted throughout the MD yet, as many farmers still hesitate to apply the new practice. For this reason, the present study, which includes environmental considerations, was conducted. The overall objective of the study was to compare the 3R3G and non-3R3G rice production models in relation to economic and environmental considerations.

Specific objectives were:

• To compare quantitatively the two rice production models' inputs in terms of seed, fertilizers, and pesticides.

• To explore farmers' perception of pesticide effects on their health.

• To compare the economic results of the two rice-production models, particularly in relation to the three targets (yield, rice quality and profit).

• To propose recommendations to improve the "3 reductions 3 gains" program's outcomes in the MD.


# 2. LITERATURE REVIEW

This section consists of three main parts. The first part outlines the key concepts of the subject. The second part examines empirical studies of rice production improvement in relation to seed and nitrogen use. The third part discusses the impact of agrochemicals on farmer health and the environment.

## 2.1. Some concepts

Economics is fundamentally concerned with scarcity. Scarcity is generally defined as a limited supply of a good or of services. People's needs are diverse and insatiable, but the resources for producing the things they want such as land, labor, raw materials, etc, are limited in supply. If something is scarce, there is not enough of it and it is difficult to obtain (Curtis M. Jolly, Howard A. Clonts). Scarcity requires choices to be made between alternative uses of resources. This has led to the concept of efficiency. There are many notions of efficiency, but this paper is limited to technical, economic and social efficiency.

Technical efficiency is defined as "the situation where it is impossible for a firm to produce, with the given know how, (1) a larger output from the same inputs or (2) the same output with less of one or more inputs without increasing the amount of other inputs". (Business Dictionary.com-online).

"Economic efficiency is the situation in which (with the given state of technology) it is impossible to generate a larger welfare total from the available resources". (Business Dictionary.com-online).

"Social efficiency requires that all market and non-market values be incorporated into the marginal benefits and marginal costs of production, no matter to whom they accrue. Social efficiency is obtained when marginal benefits equal marginal costs of production. In many cases, when environmental values are concerned, there may be very substantial differences between market values and social values. If we are to have rates of output that are socially efficient, decisions about resource use must take into account both types of costs, the private costs plus whatever external costs arise from adverse environmental impacts" (Field and Olewiler, 2005).

The above concepts remind us that to raise individual as well as social welfare we should use factor inputs as efficiently as possible. In addition, we should pay much attention to environmental consequences in our economic decisions. We can then improve economic as well as environmental outcomes in our society.

## 2.2. Empirical studies of rice production improvements relating to input reduction

Today, the majority of rice farmers use modern rice varieties that are high-yield with characteristics of high responsiveness to nitrogen fertilizer and high tiller ability. However, these varieties often have a dense canopy structure, which facilitates lodging and disease problems. Yield therefore is not stable and benefits may decline because of high input costs associated with the prevention of disease. The dense canopy creates a humid microenvironment favorable for diseases; especially endogenous pathogens as sheath blight and stem rot that thrive in N-rich canopies (Mew, 1991). To deal with this problem, farmers usually use fungicides to prevent yield loss. "It seems to be a fact that the more N fertilizer farmers apply, the more pesticide farmers have to use" (Quyen et al, 2004, p.70). This practice reduces farmers' profit and increases risk to the environment. In the face of this problem, rice scientists have created the concept of a "healthy rice canopy". This is a newly-developed concept. It refers to an idealized canopy with critical physiological features deemed favorable for growth, grain yield, and disease resistance. Quyen et al. have reviewed some traits like plant architecture, tiller number and leaf area index, and plant nutrients and disease. Past studies showed that a higher plant density and higher nitrogen application usually lead to a higher plant height because of the competition for light. Short stature reduces the susceptibility to lodging and increases the harvest index (Tsunoda, 1962). In addition, tillering plays an important role in determining rice grain yield, as it is closely related to panicle number per unit ground area. Moderate tillering facilitates synchronous flowering and maturity, more uniform panicle size, efficient use of horizontal space (Janoria 1989,), and reduces disease pressure (Mew, 1991). Nutrient

management is very important for a high yield. but it may also affect the response of rice to pests. It may also impact the development pattern of pest populations due to the change of environments within the rice canopy. Of the nutritional factors that influence the level of pest damage in a crop, total nitrogen has been considered the most critical (Quyen et al., 2004). Cuulong Delta Rice Research Institute, Vietnam, has tested the integrated effects of different seeding rates and N application levels on rice production and disease. Results showed that a precise N application (80 kg/ha) with the help of Leaf Color Chart and reduced seeding rate (100 kg/ha or even 75 kg/ha) produced a more healthy rice canopy and more grain yield (Quyen et al., 2004).

Huan, et al., 2004, in an experiment on farmers' participatory evaluation of reducing pesticides, fertilizers and seed rates in rice farming in the Mekong Delta, Vietnam, in 2001-2002, showed that seed, fertilizers, insecticides and fungicides can be reduced with little effect on yield, thereby allowing higher gross margins. These results provided the basis for launching a national mass media campaign, "Three Reductions", to push up the adoption of these practices in several provinces in the Mekong Delta.

Another study carried out by Phung, Son, and Thuan, 2003, with experiments on various soil types in Cantho, Angiang, and Dongthap provinces, showed that to maintain high yields, levels of 100-120 kg of seed/ha and 80-100 kg of nitrogen/ha in the dry season were recommended. Under the condition of good land leveling, seeding rates can be reduced to 60 kg/ha with no loss of rice yield.

According to technical instructions by agricultural experts, in order to gain better outcomes in rice production, some basic procedures in the 3R3G technique involve: (1) Careful land preparation, good seed selection and proper seed treatment; (2) Sparsely sowing by row seeder or by hand at the densities of 80-120kg/ha; (3) Good irrigation control; (4) Pest prevention by the IPM method: i.e. only use plant protection chemicals when necessary; (5) Proper fertilizer application. Combining organic and inorganic fertilizers if possible. Applying nitrogen fertilizer using the Leaf Color Chart; (6) Timely harvesting and adequate paddy drying (Angiang Plant Protection Sub-Department, 2005).

## 2.3. Agrochemical use and its impacts on farmer health and the environment

One of the major types of external costs is the cost inflicted on people through environmental degradation. In rice production, the use of agrochemicals has caused significant impacts on farmers' health and the environment. Indiscriminate pesticide use can result in one or more of the following: (1) health impairment due to direct or indirect exposure to hazardous chemicals; (2) contamination of ground and surface waters through runoff and seepage; (3) the transmittal of pesticide residues through the food chain to the farm family and urban consumers; (4) an increase in the resistance of pest populations to

pesticides, thereby reducing their efficacy and consequently causing pest outbreaks; (5) the reduction of beneficial insects like parasites and predators, thereby reducing the effectiveness of pest control strategies that attempt to minimize pesticide use. The incidence and magnitude of each of this effect depend on the type of chemicals, frequency and quantities applied and their persistence (Pingali, 1995).

Long-term exposure to pesticides may lead to health problems such as eye problems (Morgan, 1977), skin problems (Hamilton, 1982; Bainova, 1982), respiratory tract problems (Hock, 1987; Morgan, 1982; Nemary, 1987; Pingali, Marquez, Palis, and Rola, 1995), cardiovascular problems (Morgan, 1977), gastrointestinal tract problems (Morgan, 1977; Pingali, Marquez, Palis, and Rola, 1995) and neurological problems (Morgan, 1977). Health problems due to pesticide also lower productivity due to the farmer's absence from work during treatment and recuperation as well as the farmer's impaired capacity to work.

In addition to pesticides application, rice farmers usually apply great quantities of inorganic fertilizers to ensure or raise rice yields. Nitrogen (N), phosphorus (P) and potassium (K) are essential for achieving optimum crop yields. However, applying too much nitrogen or phosphorus to cropland can have adverse effects on the environment. Excess nitrogen and phosphorus in surface waters and nitrogen in groundwater cause eutrophication (excess algae growth) in surface waters and health problems in humans and livestock as a result of high intake of nitrogen in its nitrate form. Eutrophication is the slow, natural nutrient enrichment of streams and lakes. As algae grow and then decompose they deplete the dissolved oxygen in the water. This condition usually results in the death of fish, offensive odors, unsightliness and reduced attractiveness of the water for recreation and other public uses (Baird, 1997).

## 3.  METHODOLOGY

**Methods of analyzing data**

The present study tested two hypotheses**:**

a.  3R3G farmers use less seed, fertilizers, and pesticides than non-3R3G ones.
b.  3R3G farmers obtain higher yield, rice quality, and profits than non-3R3G ones.

To reach the first research objective, that is, to compare the two rice production models' inputs, three main material inputs (seed, fertilizers, and pesticides) were compared quantitatively to analyse the difference between the two models. Fertilizers and pesticides quantities were calculated based on their pure matters, that is, N, P, K content in inorganic fertilizers or active ingredients in pesticides. To test the differences between the two models, the Mann-Whitney test was

used (when the variables are not normally distributed) to compare the means of major variables.

To fulfill the second objective, that is, to explore farmers' perception of pesticide effects on their health, information gathered from a survey about the perception of farmers in relation to the health impacts of pesticide was used.

To attain the third objective, that is, to compare the economic results of the two rice-production models, particularly in relation to the three targets (yield, rice quality and profit), costs and returns analysis was used, using the Mann-Whitney test. At this stage, yield, net returns, and rice quality were also compared to see if the 3R3G model obtained its aims (3 Gains). Rice quality evaluation was done by means of seed and paddy price. In addition, to explore how input factors affected the profitability of the two rice-production models the profit function was used.

Finally, for the fourth objective of proposing recommendations, some recommendations were drawn from the results derived from the analysis of the first three objectives to improve the "three reductions three gains" program's outcomes in the MD.

**Methods of data collection**

The stratified sampling method was used to choose the survey sites. Three provinces in the MD (Cantho City, Angiang, and Soctrang province) that have intensive paddy farming practices were chosen for a survey to gather information for the research. Cantho City was chosen because it was the first province to be selected as a pilot site for testing the 3R3G program by the Plant Protection Department. Angiang was chosen as a study site because it is the province that is pushing the 3R3G model the most intensely. Soctrang is a coastal province, selected as a representative for coastal provinces with rice production. In each locality one district was chosen from which one commune was selected. Thus three communes were chosen: Thoi Thanh (O Mon district, Cantho City), An Hoa (Chau Thanh district, Angiang province), Truong Khanh (Long Phu district, Soctrang province). Thoi Thanh was the pilot site on which the 3R3G program was tested, while An Hoa and Truong Khanh are two communes that have received direct guidance from local governments in order to conduct the 3R3G program. The survey was conducted in October 2005 in collaboration with officers from local Economic Divisions and Plant Protection Stations in three districts. These officers helped the research team identify which farmers are practicing the 3R3G model and which are not.

The random sampling method was used to choose farmers (belonging to two separate farmer groups: 3R3G and non-3R3G farmers) for interviewing . The expected number of observations was 240 (80 for each province) consisting of two groups of farmers.

The actual number of farmers interviewed was 238, of whom 146 were 3R3G farmers (An Giang (57), Can Tho (40), Soc Trang (49)); and 91 were non-3R3G farmers (An Giang (22), Can Tho (36), Soc Trang (33)). The interviews (including questionnaires) were conducted at farmers' houses. The interviewers were young lecturers from the School of Economics and Business Administration, Cantho University.

*Primary data source:*
- Information about the implementation of the 3R3G program in each locality was collected from local authorities such as the Agricultural Extension and Plant Protection Stations.
- Data from local farmers' interviews were collected by means of a structured questionnaire containing the following information relating to two groups of farmers (3R3G and non-3R3G): rice farming household characteristics, items of rice production costs, input uses, output prices, and farmers' perceptions of impact of pesticides on their health.

Time for each interview was about 45 minutes to 1 hour. Respondents were willing to answer questions but some items took more time to answer than other ones such as detailed information about kinds and quantities of pesticides used in their crops. Some people had their records while other people had to ask their relatives in the house for the information needed. Consequently in some cases the retrieved information may not have been of a high-quality.

*Secondary data source:*
Secondary data were drawn from statistical yearbooks as well as previous studies relating to rice cultivation, input uses and environmental consequences on human health and the environment in Vietnam and Southeast Asia. Articles, official reports and government policies on rice production were also used.

# 4. RESULTS AND DISCUSSION

## 4.1. General socio-economic characteristics of the study sites
In general, the characteristics between non-3R3G and 3R3G farmers in the study sites did not differ much, except the number of years of residence, years of rice farming and number of females in the household. Years of residence of sample farmers were significantly different between the non-3R3G and 3R3G models. Years of rice farming were also different and from this data it seemed that 3R3G farmers had more experience in rice farming than non-3R3G ones. Both types of farmers had a lot of experience in rice growing (over 20 years of experience).

The education level of the surveyed farmers in the study sites was low for both types of farmers. Most of them left school after grade 7. This is common in the

MD because of poor conditions and other causes such as bad transportation due to the complicated waterway systems, inefficient state investment in building schools, lack of school teachers, lack of study time due to having to help their parents in cultivating work, etc. This limited their learning capacity, particularly in relation to their ability to receiving scientific and technological knowledge. Consequently, opportunities to improve income are reduced since farmer education plays an important role in the allocative and technical efficiency of farmers (Welch, 1970; Schultz, 1975).

The household size for the two models averaged 5 persons. Female members made up about 50% of the total. On average, the number of females in the 3R3G model was greater than that of the non-3R3G one, which might suggest that females were more interested in the benefits of the new technique such as reduced input costs, reduced pesticides use and reduced exposure – thereby protecting their relatives' health.

**Table 1**: **Characteristics of surveyed farmers in the study sites**

| Characteristics | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | |
| Years of residence | 40.36 | 42.44 | 10.48 | 11.75 | -1.80* |
| Years of rice farming | 23.01 | 26.81 | 11.82 | 11.31 | -2.29** |
| Age of respondents ((years) | 45.61 | 47.06 | 11.52 | 10.87 | -1.55 |
| Education level (schooling years) | 6.74 | 7.10 | 3.12 | 3.11 | -0.83 |
| Household size (persons) | 5.32 | 5.45 | 2.01 | 1.96 | -1.20 |
| of which: female | 2.30 | 2.82 | 1.31 | 1.41 | -3.38*** |
| Labor (persons) | 4.12 | 4.28 | 1.76 | 1.90 | -0.59 |
| Farm size (ha) | 2.02 | 2.27 | 1.90 | 3.34 | -0.11 |
| of which: paddy land area (ha) | 1.92 | 2.10 | 1.77 | 3.15 | -0.36 |

*,**, ***: Significance level at 0.10, 0.05 and 0.01, respectively.
Source: 2005 survey

A household typically comprised 4 workers. This number usually consisted of the father, mother, two adult children (however, not all children work in the agricultural field. They often work in other fields such as industrial, commercial or educational sectors). A lack of workers in the rice fields in some households meant that the 3R3G model could not be applied. This is because frequent visits to paddy fields are required in order to get good results in rice quality and productivity.

## 4.2. Paddy varieties use in the study sites

Survey statistics showed that rice varieties that were popular in the study sites included: IR 50404, OM 1490, OM2517, OM2717, OM2718, OMCS2000, OM3238, Tai Nguyen, ST3, ST5, Jasmine 85, etc. Today, most MD farmers have realized the importance of paddy seed for good results in cultivation.

Farmers have shifted to grow high yielding rice varieties, usually nitrogen-response varieties. These have short growth duration, ranging from 85-110 days.

**Table 2**: **Seed quantity used in the study sites, 04-05 Winter-Spring crop, kg/ha**

|  | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G |  |
| Seed quantity | 180 | 142 | 83 | 43 | -5.29*** |

*\*\*\*: Significance level at 0.01.*
*Source: 2005 survey*

Survey results indicated that non-3R3G farmers used far more seeds than 3R3G farmers. According to the recommendations given by the agricultural extension agency, seed quantities necessary for 1 ha are about 100-120 kg/ha for hand sowing and 70-100 kg/ha for machine sowing (row seeders). Comparing the figures in Table 2 with recommended rates, we could see that seed quantities used by the two groups of farmers were greater than the recommended rates. This was because MD farmers have been familiar with the traditional practice of densely sowing, usually over 200 kg of seed per ha, and changing a long-established practice has not been an easy task for agricultural agencies. However, seed quantities used by the two groups considerably decreased compared with the traditional practice. These figures reflect some success of the 3R3G advertising campaign in mass media. Farmers living outside the demonstration sites (usually consisting of about 30 hectares per site) also absorbed some of the advertising for 3R3G and applied it to their fields. It was not easy to distinctly separate between those who applied the 3R3G model and who did not.

According to technical instructions issued by agricultural agencies, to get good results in terms of yield, 3R3G farmers should use row seeders to sow seed. This practice empirically helped reduce seed quantity per ha to recommended rates without reducing rice yields and helped farmers take care of their paddy fields more easily. Paddy grown in rows has enough space for the paddy to develop well and while the airy space helps reduce insects density (e.g. brown plant hoppers), thus reducing pesticide needs. It may also reduce the need for nitrogen fertilizer. However, due to financial difficulties, not many farmers could purchase row seeders (despite the price being relatively low) even though they knew the distinct advantages of row seeding compared to hand sowing. However, machine sowing takes more sowing time and labor than hand seeding in addition to the need for a flat land surface. Survey statistics showed that the percentage of farmers using row seeders was much smaller than those practicing hand sowing. (Appendix, Table A1). This is the main reason why surveyed seed quantities did not decline to the expected rates.

The choice of varieties depends on individual farmers. Table 3 reveals some farmers' reasons for choosing a certain variety. High yields, being suitable to local conditions and easy to sell were the most common reasons.

**Table 3**: **Reasons for farmers to choose paddy varieties in the study sites, %**

| Reasons | Non-3R3G | 3R3G |
|---|---|---|
| Agricultural extension | 1.0 | 2.0 |
| High yields | 12.0 | 18.5 |
| Pest-resistance | 5.9 | 6.3 |
| Good rice quality | 3.8 | 2.0 |
| Being suitable to local conditions | 10.0 | 9.6 |
| Easy sale | 6.5 | 14.9 |

*Source: 2005 Survey*

As for sources for obtaining seeds, data collected showed that non-3R3G farmers usually propagated seeds themselves or bought seeds from other local farmers while 3R3G farmers tended to buy seeds from Seed Stations or local farmers (Appendix, Table A2).

### 4.3. Fertilizer use in the study sites

The kinds of common inorganic fertilizers in the study sites were: Urea, Phosphate, DAP, Kali, NPK 20-20-0, 20-20-15, 16-16-8, 30-20-5, Con co 1, Con co 2, Con co 3, Con co MTU, Con co cai tao. These fertilizers had different nutrient contents so the amount of pure nutrients in each kind applied per hectare was calculated to get the nitrogen, phosphorus, and potassium quantity/ha.

**Table 4**: **Comparison of inorganic fertilizer use between the two models, 04-05 Winter-Spring**

| | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| Nutrients | Non-3R3G | 3R3G | Non-3R3G | 3R3G | |
| N (kg/ha) | 122.30 | 99.78 | 89.67 | 42.10 | -3.40[***] |
| $P_2O_5$ (kg/ha) | 74.06 | 63.19 | 63.31 | 32.15 | -1.41 |
| $K_2O$ (kg/ha) | 37.11 | 46.93 | 30.75 | 34.73 | -2.41[**]. |

*Source: 2005 Survey*
*\*\*, \*\*\*: Significance level at 0.05 and 0.01, respectively*

Table 4 shows the quantities of N, $P_2O_5$ and $K_2O$ used by non-3R3G and 3R3G farmers in the study sites for the 2004-2005 winter-spring crop. 3G3G farmers used less nitrogen but more potassium than non-3R3G ones. The rising trend of applying potassium was also reflected in a study conducted by Huan et al. (2004). The mean difference of $P_2O_5$ was not significant. This meant that the

3R3G program had good effect on the quantity of nitrogen fertilizers but less effect on phosphorus used in growing rice. As we mentioned earlier, MD farmers tend to overuse nitrogen fertilizers compared to recommended rates proposed by agricultural institutions such as Cantho University or the Cuu Long Delta Rice Research Institute. One of the aims of the program was to reduce nitrogen fertilizers to the recommended rates. The inorganic fertilizer rates for the dry and wet seasons recommended by Cantho University were as follows:

**Table 5:** **Recommended inorganic fertilizer quantities in rice production in the MD, kg/ha.**

| Nutrients | Alluvial Soil | | Acid sulphate Soil | |
|---|---|---|---|---|
| | Dry season | Wet season | Dry season | Wet season |
| N | 120 | 100 | 100 | 80 |
| $P_2O_5$ | 30 | 50 | 50 | 80 |
| $K_2O$ | 30 | 30 | 30 | 30 |

*Source: Seminar document: Measures to raise summer-autumn yields in the MD. 2003. School of Agriculture, Cantho University.*

Most rice land in the MD belongs to the first category (Alluvial Soil). Non-3R3G farmers tended to use much more nitrogen fertilizers than 3R3G farmers and they did not reduce N to recommended rates while 3R3G farmers cut down the use of N further. Both types of farmers used much more phosphorus than recommended rates. For $K_2O$, the amount used in the 3R3G model was higher than the non-3R3G model and much higher than the recommended rate. This data shows that rice farmers still use inorganic fertilizers wastefully. According to instructional documents given in training courses, to reduce nitrogen fertilizer quantity to recommended rates, farmers can compare the color of paddy leaves with the colors in The Leaf Color Chart supplied to farmers by local agricultural agencies to choose appropriate nitrogen amount. However, for $P_2O_5$ and $K_2O$, there were no equivalent concrete instructions.

Information from the survey showed that MD farmers usually relied on experience to choose rates of fertilizers to apply to their fields (Appendix, Table A3). A considerable number of 3R3G farmers also applied fertilizers according to agricultural experts' advice and the Leaf Color Chart (a smaller number of non-3R3G farmers did this also). Here, the results showed that the two groups of farmers used the Leaf Color Chart to determine necessary nitrogen quantity to be applied, as this tool was usually given to them free of charge.

Analyzing the results more closely (Table 6), in O Mon district, Cantho City and Long Phu district, Soctrang province, fertilizer quantities of the 3R3G model were much smaller than those of the non-3R3G model. However, in Angiang province, total fertilizers did not differ between the two groups. This could be due to the impact of the strong advertising campaign for the 3R3G

program. In Chau Thanh district, Angiang province, non-3R3G farmers also reduced their quantity of fertilizers. If comparing the nitrogen rate used by Angiang farmers with the recommended rates of Cantho University, we could see that the An Giang rate was within the recommended rates. For example, recommended rates of nitrogen fertilizer in the MD by Cantho University was 100-120 kg of N per ha in Winter-Spring crop while Angiang farmers used some 104 kg of N. This meant that An Giang farmers switched to the technological advances more actively than other localities, which likely reflects the strong effort of the An Giang government to push its agricultural economy. Angiang has been considered as the largest rice-producing province in Vietnam. This may be due to the dynamics of Angiang government in propagating agricultural, scientific and technological advances to its farmers.

**Table 6**:    **Inorganic fertilizer use in the study sites, 04-05 Winter-Spring crop, kg/ha**

| Nutrients | Cantho | | Angiang | | Soctrang | |
|---|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| N | 134.53 | 96.52 | 105.10 | 102.22 | 120.42 | 99.60 |
| P2O5 | 77.03 | 48.83 | 66.67 | 67.32 | 75.73 | 70.41 |
| K2O | 46.27 | 45.03 | 49.48 | 60.52 | 18.85 | 32.07 |

*Source: 2005 Survey*

The choice of types of fertilizers also depends on farmers' experience. The data collected indicates that a great percentage of respondents chose fertilizers based on the knowledge of fertilizer usage given to them by their parents combined with what they learned from the media. The data also showed that a considerable percentage of 3R3G farmers chose types of inorganic fertilizers through lessons learned from 3R3G training classes, organized by local agricultural extension or plant protection stations (Appendix, Table A4).

## 4.4.  Pesticide use in the study sites
Rice farmers usually apply various kinds of pesticides to cope with pests. Table 7 indicates the quantity of pesticides used in the 04/05 winter-spring paddy crop. There was no significant difference in total pesticide (or individual types) used between the two models. In fact, non-3R3G farmers may have used more pesticides than 3R3G farmers, as the former, although they said that they had applied many kinds of pesticides, could not remember all the types they had used. Most farmers did not keep adequate records due to low education, thus they could not fully recall their pesticide use.

**Table 7**: **Quantity of pesticides used in the 2004-2005 winter-spring crop (gram a.i./ha)**

| Kinds of pesticides | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | |
| Herbicide | 202.37 | 228.97 | 338.15 | 347.64 | -1.59 NS |
| Insecticide | 240.11 | 213.90 | 319.81 | 392.23 | -0.51 NS |
| Fungicide | 521.61 | 423.40 | 684.10 | 683.35 | -1.43 NS |
| Total pesticides | 971.10 | 886.27 | 842.40 | 816.89 | -0.80 NS |

*NS: non-significance*
*Source: 2005 Survey*

## Frequency of pesticide applications

Table 8 shows that the number of insecticide and fungicide applications was significantly different between the two groups of farmers in the three provinces. However, there was no significant difference in the number of herbicides and mixed pesticides applications. In this survey, the two groups of farmers mostly used fungicides, and as in the 04-05 winter-spring crop, blast disease developed heavily.

**Table 8**: **Number of Pesticide Applications of MD farmers (04-05 winter-spring crop) (times)**

| | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | |
| Herbicide | 1.18 | 1.07 | 0.54 | 0.62 | -1.51 |
| Insecticide | 2.32 | 1.69 | 1.65 | 1.30 | -2.77*** |
| Fungicide | 2.90 | 2.13 | 1.68 | 1.28 | -3.45*** |
| Mixed | 0.69 | 0.74 | 1.49 | 1.36 | -0.76 |
| Total | 6.07 | 5.21 | 2.91 | 2.93 | -2.27** |

*\*\*, \*\*\*: Significance level at 0.05 and 0.01, respectively.*
*Source: 2005 Survey*

Data on the number of pesticide applications by province are shown in Table 9. At the study site in Omon district, Cantho City, 3R3G farmers sprayed insecticides and fungicides more frequently than non-3R3G farmers. This contradicted the expectations of agricultural officers who launched the 3R3G program in the Omon district, as when the "3 reductions" program was launched, the 3R3G techniques were transferred to all rice farmers. This site was one of the first pilot sites of the program in Cantho province in 2002, however, when reviewing the results of the program it was found that some farmers that had attended the 3R3G classes did not actually apply the program. Farmers gave reasons for not applying the program such as a lack of direct family workers to take care of the paddy fields. The 3R3G program requires the frequent application of the knowledge of integrated pest management as explained in the IPM training classes. The 3R3G program is based on IPM knowledge in order to reduce pesticide applications. This requires frequent visits to paddy fields to monitor pest development and timely intervention. If

farmers cannot do this, they usually use preventive measures such as spraying insecticides when they see any insects appearing in the fields. Besides, the distinction between the two groups of farmers in the Omon district is not clear. When conducting the survey, we chose farmers to be 3R3G or non-3R3G based on their answer to the question of whether they were applying the former technique or not. This could be an appropriate explanation for Cantho's paradoxical case of heavy pesticide application between the two groups of farmers.

## Table 9: Pesticide Applications by province, 04-05 winter-spring crop, times

| | Cantho | | | Angiang | | | Soctrang | | |
|---|---|---|---|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Z statistic | Non-3R3G | 3R3G | Z statistic | Non-3R3G | 3R3G | Z statistic |
| Herbicides | 1.25 | 1.28 | -1.05 | 1.18 | 1.23 | -0.45 | 1.31 | 1.24 | -2.07** |
| Insecticides | 1.72 | 2.50 | -3.67*** | 2.79 | 2.44 | -1.53 | 3.67 | 1.27 | -2.96*** |
| Fungicides | 2.26 | 3.03 | -2.89*** | 3.60 | 2.71 | -2.97*** | 3.70 | 1.69 | -2.26** |
| Mixed | 1.75 | 3.11 | -0.77 | 2.50 | 2.60 | -2.33** | 3.56 | 1.43 | -0.73 |
| Total | 4.64 | 5.97 | -4.51*** | 7.32 | 6.61 | -1.03 | 8.68 | 3.21 | -2.74*** |

*\*\*, \*\*\*: Significance level at 0.05 and 0.01, respectively.*
*Source: 2005 Survey*

At the study sites in Angiang and Soctrang, the number of applications of almost all pesticide types of 3R3G groups was smaller than that of non-3R3G groups. This could be due to the two survey sites receiving strong support from the local government such as training, seed grants, technical advice from agricultural extension officers or plant protection officers and leaflets. In Soctrang province (Truong Khanh commune), the number of pesticide applications dropped sharply from 8.68 to 3.21. Soctrang has not yet developed the 3R3G program on large scale like Angiang province. To push up the 3R3G model in the whole province, the provincial authorities chose Truong Khanh commune as a focus point to concentrate their effort in the hope that the province would get good results and could be used as an example for the rest of the province. Hence, funds and necessary personnel was provided to this site and as a result there was a drastic reduction in pesticide applications.

**Farmers' Perception and Behavior in Pesticide Application**
The survey results show that the perception of the two farmer groups on the impact of pesticide on their health was different. The non-3R3G group did not pay much attention to the adverse effects of pesticide use on their health. The percentage of farmers who responded "No Effect" in the Non-3R3G group (14.3%) was greater than the 3R3G (8.2%) while those who responded "Much Effect" in the Non-3R3G group (25.3%) was much smaller than the 3R3G group (40.4%). The symptoms that farmers usually suffered included eye and

skin irritation, headache, dizziness, fatigue and sleeping trouble (Appendix, Table A5). Consequently, improved health was one reason why 3R3G farmers chose the 3R3G technique.

**Table 10**: **Farmers' perception of their health with prolonged pesticide use, %**

| Degree of effect | Non-3R3G | 3R3G |
|---|---|---|
| No effect | 14.3 | 8.2 |
| Very little effect | 4.4 | 2.7 |
| Little effect | 17.6 | 21.2 |
| Moderate | 36.3 | 25.3 |
| Much effect | 25.3 | 40.4 |
| Extremely large effect | 2.2 | 2.1 |

*Source: 2005 Survey*

Actions used by farmers to protect their health also differed between the two groups. Table 11 shows the number of 3R3G farmers who used protective equipment when spraying was greater than that of non-3R3G farmers. Within each group, the number of users was much greater than that of non-users. For non-users belonging to the non-3R3G group, two common reasons for not using protective equipment were that farmers did not feel protective equipment was necessary and secondly they had no information about protective equipment. For non-users within the 3R3G group, the main reasons for not using protective equipment was that it was uncomfortable or viewed as unnecessary.

**Table 11**: **Farmers' use of protective equipment when spraying pesticides, %**

| Equipment Users/Non Users | Non-3R3G | 3R3G |
|---|---|---|
| Users | 64.8 | 80.8 |
| Non-users: due to | 35.2 | 19.2 |
| - No money to buy | 1.1 | - |
| - Discomfort | - | 5.5 |
| - No necessity | 5.5 | 3.4 |
| - No knowledge of pesticide impacts | - | 0.7 |
| - No information about protective equipment | 6.6 | 0.7 |

*Source: 2005 Survey*

During pesticide spraying, farmers usually wore a protective kit consisting of: protective helmets, mouth & nose covers, trousers and shirts with long sleeves. Mouth covers and full clothing were the most commonly used. 3R3G farmers tended to wear more protective components than non-3R3G farmers. This is likely due to a greater awareness of 3R3G farmers' about the harmful effects of pesticides. (Appendix, Table A6).

When choosing which pesticide to use, MD farmers relied on information additional to their experience. Most frequently, information was gathered from agricultural extension officers, television and input sellers. Information was also

retrieved from radio to a lesser extent. Newspapers and seminars had the least impact on farmers, as these means could not compete with the popularity of television in rural areas (Appendix, Table A7).

## 4.5. Farmers' Perception in choosing rice production models

In order to explore farmers' thoughts about the 3R3G program, the questionnaire had a section relating to farmers' behaviors toward the program. Some reasons why farmers either adopted or did not adopt the program are listed below:

For 3R3G farmers, the first consideration was cost cutting, secondly was increased income and thirdly was protecting health. A considerable number of respondents also said that they adopted the program partly because there was encouragement from local authorities (Appendix, Table A10).

For non-3R3G farmers, many reasons were given by farmers when asked why they did not apply the program. The most common reason was that they did not receive sufficient help from the local government to implement the program. Help was usually represented in the form of training classes, technical advice from agricultural extension officers, free leaf color charts and subsidized row seeders and seed. In fact, in order to carry out the 3R3G program throughout the country, the state agencies and research institutes provided financial as well as technical support to farmers involving in pilot projects. From these farmers, outcomes would be spread to other farmers living outside the project areas. Different budget limitations and the determination levels of local governments resulted in the impact of the 3R3G program differing in different provinces. Freshwater provinces seemed to carry out the program more strongly than those with brackish water. Soctrang province was a typical example. The Truong Khanh commune of Long Phu district in Soctrang was a pilot site where the Soctrang government attempted to apply the 3R3G program. Only farmers in the project area received special technical and material help from local authorities to apply the 3R3G model. Hence, farmers outside the project area continued to keep their traditional model: dense sowing, nitrogen and pesticide overuse.

There were many additional reasons why farmers refused to adopt the new model, these included: lack of family labor, fear of yellow snails, inappropriate land conditions, being unable to control irrigation, being familiar with the old model and not trusting the new model. Lack of family labor meant that some households could not follow the new model as it required a lot commitment to the field. Fear of yellow snails was also a concern as snails eat young seedlings when seeds are sparsely sowed resulting in yield loss (Appendix, Table A11).

## 4.6. Comparative analysis of the two rice production models

### 4.6.1 Costs and returns analysis

The analytical results of costs/returns economic indicators for the two models are shown in Table 12. It was hypothesized that the 3R3G model brought higher yields to 3R3G farmers. However, in this paper the results show that the mean yield difference is not statistically significant.

Paddy yields depend on many factors aside from physical inputs. Pest outbreak, bad irrigation, drought, flood, lack of monitoring, etc. can cause yield loss. Thus, farmers may not obtain high yields if their paddy fields face any of these disadvantageous conditions.

**Table 12: Rice Production Results in the study sites, 04-05 Winter-Spring Crop**

| Items | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | |
| Yields (kg/ha) | 7,840 | 7,700 | 948.88 | 1,063.67 | -1.08 |
| Returns (VND) | 16,279,000 | 17,137,000 | 2,767,753.60 | 3,861,523.29 | -1.82$^*$ |
| Seed cost (VND) | 461,000 | 438,000 | 265,802.92 | 205,510.41 | -0.90 |
| Pesticide cost (VND) | 676,000 | 573,000 | 426,085.94 | 337,599.77 | -1.41 |
| Fertilizer cost (VND) | 2,288,000 | 1,898,000 | 1,611,864.77 | 808,751.93 | -2.53$^{**}$ |
| Labor cost (VND) | 1,158,000 | 1,267,000 | 436,276.17 | 521,789.03 | -1.50 |
| Other cost (VND) | 620,000 | 766,000 | 591,000.62 | 702,068.09 | -1.29 |
| Total cost (VND) | 5,206,000 | 4,941,000 | 1,861,335.02 | 1,338,787.61 | -1.08 |
| Net returns (VND) | 11,073,000 | 12,196,000 | 2,928,151.51 | 3,894,827.71 | -2.35$^{**}$ |
| Cost/kg of paddy (VND) | 670 | 650 | 237,22 | 195.66 | -0.56 |
| Net returns/Cost ratio (times) | 2.46 | 2.72 | 1.70 | 1.45 | -2.28** |
| Net returns/Return ratio (times) | 0.67 | 0.70 | 0.11 | 0.11 | -2.28$^{**}$ |

*Source: 2005 Survey*

*\*, \*\*: Significance level at 0.10, 0.05, respectively.*

*Notes:*

*Returns = Yields in kg \* price per kg*

*Total costs     = seed, pesticide, fertilizer, labor and other costs*

*Net returns     = Returns – Total costs*

Although there were no clear differences in yield, rice returns were higher for 3R3G farmers.

Higher rice returns for 3R3G farmers could be due to the fact that the 3R3G technique results in better-quality rice. Thus, 3R3G output may receive a higher price than that of the non-3R3G technique, resulting in to greater returns. Rice quality is also reflected in seed price. Good eating rice varieties sell at a higher price. Table 13 shows the statistically significant differences in seed and paddy price between the two models. In general, 3R3G farmers used better-quality seed and produced better-quality rice than non-3R3G ones.

**Table 13: Seed and paddy price in the study sites, 04-05 Winter-Spring Crop, VND/kg**

| | Mean | | Std. Dev. | | Z statistic |
|---|---|---|---|---|---|
| | **Non-3R3G** | **3R3G** | **Non-3R3G** | **3R3G** | |
| Seed price | 2612.70 | 3197.94 | 743.03 | 1201.91 | -3.75*** |
| Paddy price | 2076.67 | 2244.14 | 250.37 | 364.85 | -4.23*** |

*\*\*\*: Significance level at 0.01*
*Source: 2005 Survey*

In Table 12, seed cost between the two models is not significantly different. This is due to the fact that although 3R3G farmers used less seed their seed price was higher (Table 13), thus the two factors offset each other, narrowing the gap between the two models' seed cost.

As 3R3G farmers used much less nitrogen fertilizer than non-3R3G farmers, they had lower fertilizer costs. The remaining costs such as pesticide cost, labor cost, other cost, total cost and cost per kg of paddy were not significantly different between the two models.

As 3R3G farmers obtained higher return and endured similar total costs, they had higher net returns, net return/cost ratios and net return/return ratios. Therefore, generally speaking, the 3R3G model – as compared with the non-3R3G model – reduces material input costs, raises rice quality and increases returns and net returns.

Outcomes were not similar for each province (Appendix, Table A14). Soctrang province seemed to reach targets set by the program advocates more than any of the other provinces. These targets were formulated based on the experimental results of the new techniques tried by volunteer farmers at demonstration sites in Cantho as well as some other provinces. During the testing stages, farmers usually received various forms of support from extension workers. In addition, their fields were well monitored resulting in quite convincible outcomes. However, when the program was launched extensively, due to a lack of continued support for larger areas, farmers have not stuck to initial advice from experts and have applied the techniques arbitrarily. This may be one reason why the cost and return analysis results for Cantho did not follow the general trend when data from the 3 provinces was pooled.

In Angiang, the analysis results did not show any clear differences between the two models. As previously stated, this may be due to unclear boundaries between farmers who applied the 3R3G technique and those applied traditional practices. As the guidance and propaganda work of local agencies in Angiang was relatively good, farmers that did not officially join the 3R3G group (and consequently did not receive technical advice from extension workers, nor reported their results) imitated the techniques applied by the 3R3G group.

**Some environmental benefits from the 3R3G model**

As previously stated, social efficiency requires a balance between the marginal benefit and marginal cost of resource use. However, it is a challenge to calculate all benefits and costs relating to producing goods. In this paper only some benefits were mentioned, in particular those arising from material input savings as well as those from the reduction in pesticide application in the 3R3G model. Through the 3R3G model (as compared with the non-3R3G model), farmers saved a considerable amount of seed (38kg/ha) and nitrogen fertilizer (22.5 kg of nitrogen/ha). In the MD, paddy land area is 1,500,000 ha, thus with 2 paddy crops/year there is 3,000,000 ha of paddy/year. Multiplying this figure by the above input savings, there is 114,000 tons of seed and 67,500 tons of pure nitrogen saved per year for the MD. These are socially and environmentally significant numbers. Saved seed bulk could be used for other purposes such feeding hungry people and for husbandry, etc. Also, by producing less nitrogen fertilizer, not only is less input used in production but also environmental pollution is reduced. In addition, reducing the number of pesticide applications will improve the health of sprayers as well as the surrounding environment. Therefore, the 3R3G model can help MD farmers as well as society to reduce economic and environmental costs, creating considerable benefits for society.

**4.6.2 Regression analysis of the two rice production models**

Profit is one of the most important goals of any business entity. To explore which rice-production model created more profits for rice farmers and to examine how input factors influenced the profitability of each model, the following profit function was used:

$$\text{net} = a_0 + a_1\text{seedc} + a_2\text{laborc} + a_3 \text{ferc} + a_4 \text{pestc} + a_5 \text{otherc} + a_6 \text{yield} + a_7 \text{RG}$$

where:

net = net returns of the 04-05 winter-spring crop, VND/ha

seedc = seed cost, VND/ha

laborc = labor cost, VND/ha

ferc = fertilizer cost, VND/ha

pesc = pesticide cost, VND/ha

otherc = other costs, VND/ha

yield = paddy yield, kg/ha

RG = dummy variable for the 3R3G model (RG =1 if 3R3G model, = 0 if non-3R3G)

$a_0$, $a_1$, $a_2$, = regression coefficients indicating the impact of each independent variable on the      dependent variable, net.

The results of the regression analysis were:

1.  **Model 1**: including all observations of the 3R3G and non-3R3G models in the three provinces (n=235)

    Net = -845757.4 + 1.2841seedc – 1.1313***laborc – 0.7376***ferc – 0.7049pesc

    (-0.5066)      (1.6076)        (-2.9530)          (-4.6584)          (-1.4483)

    - 0.8193***otherc + 1957.6130***yield + 1269465.0469***RG

    (-2.9285)              (10.6118)                  (3.3040)

$$Adj.R^2 = 0.4021$$

Note: Values in parentheses are t-value

***: Significant at 0.01 level

The variables with significant coefficients were laborc, ferc, otherc, yield, and RG. Labor cost, fertilizer cost and other costs had a negative impact on net return. Meanwhile, yield and 3R3G practice had a positive impact on net return.

2.  **Model 2**: non-3R3G model (n = 91)

    Net = -832573.4422 + 0.4914seedc – 1.0039**laborc – 0.7944***ferc

    (-0.4339)              (0.6119)              (-2.0560)              (-6.0333)

    -1.1641**pesc – 0.3429otherc + 2002.0077***yield

    (-2.3335)              (-0.9580)              (8.9822)

$$Adj.R^2 = 0.5750$$

**, ***: Significant at 0.05 and 0.01 level, respectively.

In this model, the variables of laborc, ferc, pesc, and yield had significant coefficients. Labor cost, fertilizer cost, and pesticide cost had a negative impact on net return while yield had positive impact on net return.

3.  **Model 3**: 3R3G model (n = 144)

    Net = -265498.4262 + 2.0905seedc – 1.0218*laborc – 0.6175*ferc

         (-0.1087)       (1.5490)       (-1.8220)       (-1.7818)

        -0.3532pesc – 1.0003**otherc + 1945.2751***yield

        (-0.4420)       (-2.5474)       (7.3050)

    Adj.$R^2$ = 0.3193

    *, **, ***: Significant at 0.10, 0.05 and 0.01 level, respectively.

In the 3R3G model, laborc, ferc, otherc and yield had significant coefficients. Labor cost, fertilizer cost and other costs had a negative impact but yield had a positive impact on net return.

In summary, the 3R3G model creates higher profits for rice farmers. In both models, yield and seed cost had a positive impact on net return although the impact of seed cost was insignificant at 10% level. On the other hand, if the significant level of 15% is accepted in agricultural areas, seed cost's impact in the 3R3G model on net returns is more significant than in the non-3R3G model. Thus, it could be inferred that 3R3G farmers used better-quality seed, thereby producing better-quality rice and gaining a better price, which increased the profitability of the 3R3G model.

**Limitations of the study:**
This study only compared the results of the two rice production models in terms of 3 input factors and 3 output outcomes with cost and return analysis. It did not cover all the costs incurred during production process, such as the costs of adverse health effects generated from spraying pesticides. This study also could not evaluate the social cost and benefits of the two rice production models due to lack of data and specialized knowledge.

# 5. CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusions

Through the comparative analysis of the two rice production models in study sites in the MD – in terms of 3 input factors (seed rate, fertilizers, and pesticides) and 3 output outcomes (yield, rice quality, and profit) – the survey results indicated that the 3R3G model used less seed, nitrogen, pesticide applications and obtained higher rice quality and profit than the non-3R3G model. However, potassium quantity was higher and the aim of reducing pesticides and raising yield was not effectively reached, despite the number of pesticide applications being reduced. There are a couple of explanations for this. First, there could be some inexact data retrieved during data collection. Second, there may have been a gap between the demonstration sites and the application of the new model on a large scale in the MD. During the demonstration stages, there was often close monitoring of responsible agencies on the technical processes to be implemented. However, in the extensive application stage, these agencies could no longer afford to monitor and offer support at the same level, thus the outcomes were not as good as in demonstration stages. Still, with input savings, improved rice quality and increased profit, the 3R3G model has brought considerable economic and environmental benefits to MD farmers.

## 5.2 Recommendations

Although the 3R3G program has been applied in the MD for approximately 3 years, it has not yet reached outcome target levels, particularly in relation to seed rates. The recommended seed rates ranged from 70-120 kgs/ha depending on machine sowing or hand sowing, while average surveyed seed rates were 142 for the 3R3G model and 180 for non-3R3G. To reduce the gap between recommended rates and actual rates, row seeders need to be improved so that it will be accepted by farmers. Technical experts should also study whether the trend of using more potassium is rational as well as examining its effect on the environment such that the right N-P-K formula for rice production is offered in specific regions. To reduce the use of pesticides, pest-resistant rice varieties need to be put to use. The adverse impacts of pesticide use on farmers' health and the environment should also be advertised. In order for more farmers to wear protective equipment while spraying pesticides, convenience and price needs to be improved. More demonstration sites should also be established (like Truong Khanh commune, Soctrang province, case) such that there are sites in convenient locations for all farmers.

# REFERENCES

Angiang Plant Protection Sub-Department, 2005. Process of implementing 3Reductions 3 Gains. Download from http://sonongnghiep.angiang.gov.vn/webpage_1/3giam3tamg_files/ quytrinh% 2 003gi...

Baird, J.V. 1997. *Nitrogen Management and Water Quality*. North Carolina Cooerative Extension Service.

Bainova, A. 1982. Dermal absorption of pesticides. In *Toxicology of Pesticides* (pp. 41-53). European Cooperation on Environmental Health Aspects of the Control of Chemicals, Interim Document 9. Copenhagen: WHO Regional Office for Europe.

Curtis M. Jolly and Howard A. Clonts. Economics of Aquaculture. Food Products Press, an imprint of The Haworth Press, Inc. New York, London, Norwood (Australia).

Dung, N. H. and Dung T.T.T, 1999. "Economic and health consequences of pesticide use in paddy production in the Mekong Delta, Vietnam". Economy & Environment, Case studies in Vietnam. Economy and Environment Program for Southeast Asia (EEPSEA).

Dung, N.H. et al, 1999. "Impact of agrochemical use on productivity and health". Economy & Environment, Case studies in Vietnam. Economy and Environment Program for Southeast Asia (EEPSEA).

Dung.N.H..2000. Hien trang va chinh sach kiem soat o nhiem do nong duoc va phan hoa hoc su dung trong san xuat lua tai Dong Bang Song Cuu Long. Personal paper at the seminar on pollution-control policy on the use of agrochemicals in rice production systems in the Mekong River Delta.

Hamilton, D.J. 1982. Protective clothing for spray operators in the tropics. In J. Miyamoto and P.C. Kearney (eds.), Pesticide Chemistry: Human welfare and the Environment. Indooroopilly, Australia. Proceedings of the Fifth International Congress of Pesticide Chemistry, Kyoto, Japan, August 29-September 4, 1982. Oxford: Pergamon Press.

Huan, N.H., and L.V. Thiet et al.. 2000. Ket qua dieu tra ve niem tin, thai do va tap quan su dụng thuoc bao ve thuc vat an toan, hieu qua (Farmer Perceptions, Knowledge, and Pesticide Use Practices). Personal paper.

Huan, N.H., L.V. Thiet, H.V. Chien, and K.L. Heong. 2004. Farmers' participatory evaluation of reducing pesticides, fertilizers and seed rates in rice farming in the Mekong Delta, Vietnam. Crop Protection.

Huan N.H. and D.T. Anh. 2000. Reducing risks of plant protection chemicals in Vietnam_ Present situation and solutions. Paper presented at the Seminar: Pollution control policy on the use of chemical fertilizers and pesticides in

rice production in the Mekong Delta of Vietnam. HCM City University of Economics. 25/11/2000.

Janoria MP, 1989. A basic plant ideotype for rice. Intl. Rice Res. Newsl. 14(3):12-13.

Mew T. 1991. Disease management in rice. Pages 279-299. In: D. Pimentel, ed. CRC Handbook of Pest Management in Agriculture, Second Edition, Vol. III. CRC Press Inc., Boston.

Morgan, D.P. 1977. *Recognition and management of pesticide poisonings* (second cd.). Washington, D.C.: U.S. Environmental Protection Agency, Office of pesticide programs.

Morgan, D.P. 1982. *Recognition and management of pesticide poisonings*. Washington, D.C.: U.S. Environmental Protection Agency.

Phuong, D. M., Gopalakrishnan, C. 2003. An application of the contingent valuation method to estimate the loss of value of water resources due to pesticide contamination: the case of the Mekong Delta, Vietnam.

Phung, C.V., D.H. Son, and T.H. Thuan, 2003. Effects of Seeding Rates and Nitrogen Dosages on Yield of some High Yielding Varieties Growing on Alluvial Doils. Omonrice 11 (2003).

Pingali P.L. 1995. "Impact of pesticides on farmer health and the rice environment: an overview of results from a multidisciplinary study in the Philippines".pp 109-119.

Pingali, P.L., C.B. Marquez, F.G. Palis, and A.C. Rola. The Impact of Pesticides on Farmer Health: A Medical and Economic Analysis in the Philippines. IRRI.

Quyen, N. V., Tan, P.S., Hach, C.V., Du, P.V., and X. Zhong. Healthy rice canopy for optimal production and profitability. Omonrice 12: 69-74 (2004). Cuulong Delta Rice Research Institute, Vietnam

Schultz, T.W. 1975. *The value of the ability to deal with disequilibria*. Journal of Economic Literature 13: 827-846.

Xuan, V.T. 2005. Cay lua Viet Nam chuyen minh trong thuo dat nuoc thai binh. Download from http://web.thanhnien.com.vn/Chaobuoisang/Lang-kinh-cuoi-tuan/2005/4/30/10861.

Welch, F. 1970. Education in production. Journal of Political Economy 78: 35-39.

Reports presented at the Three Reductions Three Gains Review Meeting. Cuulong Delta Rice Research Institute. 2004.

Seminar document: Measures to raise summer-autumn yields in the MD. 2003. School of Agriculture, Cantho University.

Tong ket chuong trinh "Ba giam, ba tang" 2002-2004. Download from http://sonongnghiep.angiang.gov.vn/webpage_1/3giam3tang_files/trienvong

BusinessDictionary.com-online

# APPENDICES

Table A1: **Ways of paddy sowing in the study sites, 2004-2005, %**

|  | Cantho | | Angiang | | Soctrang | |
|---|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| Hand sowing | 100.0 | 92.5 | 87.0 | 56.1 | 78.8 | 83.7 |
| Machine sowing | 0 | 7.5 | 13.0 | 42.1 | 21.2 | 10.2 |

Source: 2005 Survey

Table A2: **Sources of seed, %**

| Sources | Cantho | | Angiang | | Soctrang | |
|---|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| Self-seed propagating | 25.0 | 27.5 | 15.8 | 30.3 | 12.2 | 17.8 |
| Seed Stations | 19.4 | 7.5 | 61.4 | 18.2 | 34.7 | 37.7 |
| Local farmers | 55.6 | 52.5 | 19.3 | 57.6 | 42.9 | 36.3 |
| Seed Production Companies | - | 12.5 | 7.0 | - | -6.1 | 8.2 |

Source: 2005 Survey

Table A3: **Farmers' bases to choose rates of fertilizers, %**

|  | Cantho | | Angiang | | Soctrang | | Region | |
|---|---|---|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| Experience | 91.43 | 70.00 | 90.48 | 78.57 | 93.75 | 74.42 | 92.05 | 74.82 |
| Other farmers | 17.14 | - | - | 7.14 | 3.13 | 2.33 | 7.95 | 3.6 |
| Agricultural extension | 8.57 | 65 | 28.57 | 51.79 | 9.38 | 60.47 | 13.64 | 58.27 |
| Leaf Color Chart | 11.43 | 45 | 19.05 | 37.5 | 15.63 | 25.56 | 14.77 | 35.97 |

Source: 2005 Survey

Table A4**: Farmers' Bases to choose kinds of fertilizers, %**

| Reasons | Can Tho | | An Giang | | Soc Trang | | Region | |
|---|---|---|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| Experience | 100.0 | 80.0 | 90.9 | 82.5 | 87.9 | 65.3 | 93.4 | 79.0 |
| Other farmers | 16.7 | 2.5 | 22.7 | 5.3 | 9.1 | 10.2 | 15.4 | 6.2 |
| Agricultural extension | 11.1 | 55.0 | 27.3 | 56.1 | 15.2 | 49.0 | 16.5 | 53.4 |
| Low price | 2.8 | 5.0 | 4.5 | 5.3 | 3.0 |  | 3.3 | 3.4 |
| Family budget | - | - | 4.5 | - | - | - | 1.1 | - |

Source: 2005 Survey

Table A5**: Symptoms experienced after farmers' pesticides application, %**

|  | Cantho | | Angiang | | Soctrang | | Region | |
|---|---|---|---|---|---|---|---|---|
|  | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
| Without symptoms | 62 | 52.78 | 46.15 | 42.86 | 61.54 | 54.76 | 58.9 | 50 |
| With symptoms: | 38.24 | 47.22 | 53.85 | 57.14 | 38.46 | 45.24 | 41.1 | 50 |
| - Eye irritation | 23.08 | 50 | 11.11 | 59.09 | 22.22 | 44.44 | 20 | 51.2 |
| - Skin irritation | 23.08 | 19.44 | 22.22 | 31.82 | 22.22 | 33.33 | 22.5 | 28.8 |
| - Headache | 7.69 | 5.56 | 33.33 | 9.09 | 11.11 | 13.33 | 15 | 9.6 |

252

| | Can Tho Non-3R3G | 3R3G | An Giang Non-3R3G | 3R3G | Soc Trang Non-3R3G | 3R3G | Region Non-3R3G | 3R3G |
|---|---|---|---|---|---|---|---|---|
| - Dizziness | 30.77 | 11.11 | 22.22 | 13.64 | 16.67 | 11.11 | 22.5 | 12 |
| - Vomit | - | 11.11 | 11.11 | 4.55 | 11.11 | - | 7.5 | 4.8 |
| - Fever | - | - | - | 2.27 | - | - | - | 0.8 |
| - Convulsion | - | - | - | 2.27 | - | - | - | 0.8 |
| - Hard breath | 23.08 | 8.33 | 11.11 | 4.55 | 5.56 X | | 12.5 | 4 |
| - Heart trouble | 7.69 | 5.56 x | | 2.27 | 5.56 | 4.44 | 5 | 4 |
| - Sleep trouble | 30.77 | 13.89 | 11.11 | 15.91 | 11.11 | 6.67 | 17.5 | 12 |

Source: 2005 Survey

Table A6: **Kinds of equipment used when spraying pesticides, %**

| Items | Cantho Non-3R3G | 3R3G | Angiang Non-3R3G | 3R3G | Soctrang Non-3R3G | 3R3G | Region Non-3R3G | 3R3G |
|---|---|---|---|---|---|---|---|---|
| Protective helmets | 11.1 | 12.5 | 31.8 | 22.8 | 12.1 | 12.2 | 16.5 | 16.4 |
| Mouth and nose covers | 63.9 | 72.5 | 54.5 | 70.2 | 54.5 | 85.7 | 58.5 | 76.0 |
| Clothes (long sleeves +trousers) | 61.1 | 67.5 | 36.4 | 54.4 | 48.5 | 77.6 | 50.5 | 65.8 |
| Raincoats | 2.8 | - | - | 1.8 | 12.1 | 8.2 | 5.5 | 3.4 |
| Eye glasses | 2.8 | 20.0 | 13.6 | 5.3 | 6.1 | 4.1 | 6.6 | 8.9 |
| Gloves | 2.8 | 7.5 | 13.6 | 5.3 | 9.1 | 6.1 | 7.7 | 6.2 |

Source: 2005 Survey

Table A7: **Information sources for MD farmers to choose pesticide application, %**

| Information Source | Can Tho Non-3R3G | 3R3G | An Giang Non-3R3G | 3R3G | Soc Trang Non-3R3G | 3R3G | Region Non-3R3G | 3R3G |
|---|---|---|---|---|---|---|---|---|
| Experience | 83.3 | 67.5 | 81.8 | 70.2 | 72.7 | 67.3 | 79.1 | 68.5 |
| Agricultural extension | 8.3 | 47.5 | 31.8 | 52.6 | 12.1 | 44.9 | 15.4 | 48.6 |
| Input sellers | 25.0 | 15.0 | 22.7 | 8.8 | 21.2 | 10.2 | 23.1 | 11.0 |
| Other farmers | 11.1 | 2.5 | 9.1 | 12.3 | 12.1 | 6.1 | 11.0 | 7.5 |
| Radio | 2.8 | 5.0 | 13.6 | 10.5 | 6.1 | - | 6.6 | 5.5 |
| Television | 30.6 | 22.5 | 59.1 | 36.8 | 30.3 | 22.4 | 37.4 | 28.1 |
| Newspapers | - | - | - | 1.8 | 3.0 | 2.0 | 1.1 | 1.4 |
| Seminars | 11.1 | - | 4.5 | - | 12.1 | - | 9.9 | - |

Source: 2005 Survey

Table A8: **Farmers' perception of their health with prolonged pesticide use, %**

| Degree of effect | Can Tho Non-3R3G | 3R3G | An Giang Non-3R3G | 3R3G | Soc Trang Non-3R3G | 3R3G | Region Non-3R3G | 3R3G |
|---|---|---|---|---|---|---|---|---|
| No effect | 5.6 | 10.0 | 22.7 | 8.8 | 18.2 | 6.1 | 14.3 | 8.2 |
| Very little effect | 8.3 | 5.0 | 4.5 | 3.5 | - | - | 4.4 | 2.7 |
| Little effect | 30.6 | 17.5 | 9.1 | 26.3 | 9.1 | 18.4 | 17.6 | 21.2 |
| Moderate | 25.0 | 17.5 | 36.4 | 24.6 | 45.5 | 32.7 | 35.2 | 25.3 |
| Much effect | 25.0 | 47.5 | 27.3 | 36.8 | 27.3 | 38.8 | 26.4 | 40.4 |
| Extremely large effect | 5.6 | 2.5 | - | - | - | 4.1 | 2.2 | 2.1 |

Source: 2005 Survey

Table A9: **Farmers' reasons for not using protective equipment when spraying pesticides, by province, %**

| Reasons | Can Tho | An Giang | Soc Trang | Region |
|---|---|---|---|---|

| | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G | Non-3R3G | 3R3G |
|---|---|---|---|---|---|---|---|---|
| No money to buy | 1,0 | - | 0,0 | - | 0,0 | - | 1,1 | - |
| Discomfort | 7,0 | 7,5 | 13,6 | 7,0 | 9,1 | 2,0 | 14,3 | 5,5 |
| No necessity | 3,0 | 2,5 | 9,1 | 5,3 | 0,0 | 2,0 | 5,5 | 3,4 |
| No knowledge of pesticide impact | - | 0,0 | - | 1,8 | - | 0,0 | - | 0,7 |
| No information about protective equipment | 3,0 | 0,0 | 1,0 | 1,8 | 6,1 | 0,0 | 6,6 | 0,7 |

Source: 2005 Survey

Table A10: **Farmers' Reasons for choosing the 3R3G production model, %**

| Reasons | Cantho | Angiang | Soctrang | Region |
|---|---|---|---|---|
| To increase income | 57.5 | 73.7 | 63.3 | 65.8 |
| To cut costs | 92.5 | 89.5 | 91.8 | 91.1 |
| Local encouragement | 35.0 | 36.8 | 42.9 | 38.4 |
| To protect health | 30.0 | 24.6 | 30.6 | 28.1 |
| To imitate other people | 20.0 | 14.0 | 6.1 | 13.0 |
| Being given some material support | - | 1.8 | 2.0 | 1.4 |

Source: 2005 Survey

Table A11: **Farmers' Reasons for choosing the traditional production model, %**

| Reasons | Cantho | AnGiang | Soctrang | Region |
|---|---|---|---|---|
| No help from the state | 38.9 | 40.9 | 24.2 | 34.1 |
| Lack of family labor | 8.3 | 18.2 | 12.1 | 12.1 |
| Fear of yellow snails | 38.9 | 9.1 | 9.1 | 20.9 |
| Inappropriate land conditions | 22.2 | 4.5 | 21.2 | 17.6 |
| Unable to control irrigation | 2.8 | 9.1 | 9.1 | 6.6 |
| Familiar with the old model | 11.1 | 9.1 | 12.1 | 11.0 |
| Not to trust 3R3G model | - | 22.7 | 12.1 | 9.9 |

Source: 2005 Survey

Table A12: **Comparison of seed and paddy price in 04-05 winter-spring crop by province,**
**VND/kg**

| | Seed price | | | Paddy price | | |
|---|---|---|---|---|---|---|
| | Non-3R3G | 3R3G | Trị số Z | Non-3R3G | 3R3G | Trị số Z |
| Cantho | 2308.57 | 2417.5 | -0.25 | 2164.36 | 2113.25 | -1.01 |
| Angiang | 3112.73 | 3922.11 | -2.45** | 2280.45 | 2456.25 | -3.79*** |
| Soctrang | 2601.56 | 2969.32 | -2.37** | 1845.15 | 2102.81 | -3.56*** |

Source: 2005 Survey
***: Significance level at 0.01

Table A13: **Rice production economics in the study sites**

| Items | An Giang | | Z statistic | Can Tho | | Z statistic | Soc Trang | | Z statistic | Region | | Z statistic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Non 3R3G | 3R3G | | Non 3R3G | 3R3G | | Non 3R3G | 3R3G | | Non 3R3G | 3R3G | |
| Yields (kg/ha) | 7,760 | 7,400 | -1.42 | 7,330 | 7,880 | -2.64*** | 7,870 | 8,370 | -1.77 | 7,840 | 7,700 | -1.08 |
| Returns (VND/ha) | 17,697,000 | 17,851,000 | -0.67 | 15,529,000 | 17,112,000 | -2.62*** | 14,358,000 | 17,622,000 | -3.56*** | 16,279,000 | 17,137,000 | -1.82* |
| Seed cost (VND/ha) | 522,000 | 545,000 | -0.18 | 376,000 | 461,000 | -3.03*** | 420,000 | 363,000 | -0.26 | 461,000 | 438,000 | -0.90 |
| Pesticide (VND/ha) | 803,000 | 704,000 | -0.54 | 349,000 | 543,000 | -3.35*** | 734,000 | 603,000 | -0.98 | 676,000 | 573,000 | -1.41 |
| Fertilizer (VND/ha) | 1,775,000 | 2,019,000 | -1.22 | 1,684,000 | 2,674,000 | -3,43*** | 2,228,000 | 1,927,000 | -2.52** | 2,288,000 | 1,898,000 | -2.53** |
| Labor cost (VND/ha) | 1,201,850 | 1,154,000 | -0.31 | 1,505,000 | 1,128,000 | -2.81*** | 1,162,000 | 1,206,000 | -0.32 | 1,158,000 | 1,267,000 | -1.50 |
| Other cost (VND/ha) | 715,000 | 635,000 | -0.77 | 558,000 | 657,000 | -0.83 | 513,000 | 1,094,000 | -3.40*** | 620,000 | 766,000 | -1.29 |
| Total cost (VND/ha) | 5,017,000 | 5,057,000 | -0.81 | 4,471,000 | 5,463,000 | -2.86*** | 5,058,000 | 5,194,000 | -0.53 | 5,206,000 | 4,941,000 | -1.08 |
| Net Returns (VND/ha) | 12,679,000 | 12,794,000 | -0.30 | 11,058,000 | 11,649,000 | -1.04 | 9,300,000 | 12,428,000 | -3.70*** | 11,073,000 | 12,196,000 | -2.35** |
| Cost/kg of paddy (VND) | 651 | 670 | -0.30 | 617 | 691 | -1.54 | 663 | 624 | -0.27 | 670 | 650 | -0.56 |
| Net Returns/Cost ratio (times) | 3,17 | 2.75 | -0.37 | 2.66 | 2.37 | -1.13 | 2,05 | 2,74 | -2.18** | 2.46 | 2.72 | -2.28** |
| Net Returns/Return ratio (times) | 0,71 | 0,70 | -0.37 | 0.71 | 0.68 | -1.13 | 0,63 | 0,70 | -2.18** | 0.67 | 0.70 | -2.28** |

Source: Calculated from the 2005 survey data
**, ***: Significance level at 0.05, 0.01, respectively.

## Correlation matrix

```
cor yield seedrate larate ferrate pesrate if  RG==0
(obs=90)

            |    yield    seedrate    larate ferrate pesrate
------------+-------------------------------------------
      yield |   1.0000
   seedrate |  -0.0716   1.0000
     larate |  -0.0096   0.3276   1.0000
    ferrate |   0.0719   0.0331  -0.0371   1.0000
    pesrate |   0.0286   0.0590   0.0909   0.0784   1.0000.


or yield seedrate larate ferrate pesrate if  RG==1
(obs=142)

            |    yield    seedrate    larate ferrate pesrate
------------+-------------------------------------------
      yield |   1.0000
   seedrate |  -0.0371   1.0000
     larate |  -0.2361  -0.1327   1.0000
    ferrate |   0.0723  -0.0801   0.1092   1.0000
    pesrate |   0.0940  -0.0525  -0.0766   0.1568   1.0000


cor yield  net seedc laborc ferc pesc otherc if  RG==0
(obs=91)

            |    yield     net seedc laborc  ferc  pesc  otherc
------------+----------------------------------------------------------
      yield |   1.0000
        net |   0.6002   1.0000
      seedc |   0.0088   0.0198   1.0000
     laborc |  -0.0413  -0.1997   0.1805   1.0000
       ferc |   0.1281  -0.3521  -0.0319   0.0759   1.0000
       pesc |  -0.1232  -0.2667   0.0784   0.0455   0.0172   1.0000
     otherc |   0.0358  -0.0488   0.0452  -0.0390  -0.0488   0.1932   1.0000

cor yield  net seedc laborc ferc pesc otherc if  RG==1
(obs=144)

            |    yield     net seedc laborc  ferc  pesc  otherc
------------+----------------------------------------------------------
      yield |   1.0000
        net |   0.4994   1.0000
      seedc |  -0.0201   0.1305   1.0000
     laborc |  -0.1745  -0.2836  -0.2178   1.0000
       ferc |   0.1503  -0.0794   0.0250   0.1360   1.0000
       pesc |   0.0309  -0.0057  -0.0014  -0.1518   0.1219   1.0000
     otherc |   0.1993  -0.0984  -0.0258   0.0961   0.0671  -0.0223   1.0000
```

**Note:**
Yield (kg/ha), seedrate= seed rate (kg/ha), larate = labor rate (man-day/ha),
ferrate = fertilizer rate (kg/ha), pesrate = pesticide rate (kg/ha)


## Regression results

1. **3R3G and non-3R3G model**
. reg net seedc laborc ferc pesc otherc yield  RG

```
      Source |       SS        df       MS              Number of obs =     235
-------------+------------------------------            F( 7,    227) =   23.48
       Model | 1.2664e+15     7  1.8092e+14            Prob > F      =  0.0000
    Residual | 1.7487e+15   227  7.7036e+12            R-squared     =  0.4200
```

256

```
-------------+------------------------------          Adj R-squared =  0.4021
       Total |  3.0151e+15   234  1.2885e+13          Root MSE      =  2.8e+0
> 6


------------------------------------------------------------------------------
         net |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       seedc |   1.284054    .7987574     1.61   0.109    -.2898725    2.857981
      laborc |  -1.131281    .3830966    -2.95   0.003    -1.886162   -.3764013
        ferc |  -.7376227    .1583419    -4.66   0.000     -1.04963   -.4256149
        pesc |  -.7049394    .4867205    -1.45   0.149    -1.664007    .2541285
      otherc |  -.8193078    .2797677    -2.93   0.004    -1.370582    -.268034
       yield |   1957.613    184.4755    10.61   0.000      1594.11    2321.116
          RG |    1269465    384226.1     3.30   0.001     512359.2     2026571
       _cons |  -845757.4     1669502    -0.51   0.613     -4135461     2443946
------------------------------------------------------------------------------
```

2. **Non–3R3G model**
 reg net seedc laborc ferc pesc otherc yield  if RG==0

```
      Source |       SS       df       MS              Number of obs =      91
-------------+------------------------------          F(  6,    84) =   21.30
       Model |  4.8572e+14     6  8.0953e+13          Prob > F      =  0.0000
    Residual |  3.1932e+14    84  3.8014e+12          R-squared     =  0.6033
-------------+------------------------------          Adj R-squared =  0.5750
       Total |  8.0504e+14    90  8.9449e+12          Root MSE      =  1.9e+0
> 6


------------------------------------------------------------------------------
         net |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       seedc |   .4913603    .8030549     0.61   0.542    -1.105602    2.088323
      laborc |  -1.003888    .4882682    -2.06   0.043    -1.974863   -.0329131
        ferc |  -.7943623     .131662    -6.03   0.000    -1.056187   -.5325379
        pesc |  -1.164146    .4988939    -2.33   0.022    -2.156252   -.1720411
      otherc |  -.3428628    .3578981    -0.96   0.341    -1.054582    .3688568
       yield |   2002.008    222.8852     8.98   0.000     1558.776    2445.239
       _cons |  -832573.4     1918811    -0.43   0.665     -4648340     2983193
------------------------------------------------------------------------------
```

. ovtest, rhs

Ramsey RESET test using powers of the independent variables
       Ho:  model has no omitted variables
             F(18, 66) =      1.12
               Prob > F =      0.3544


. vif

```
    Variable |       VIF       1/VIF
-------------+----------------------
        pesc |      1.07    0.937572
      otherc |      1.05    0.952492
      laborc |      1.05    0.955121
       seedc |      1.04    0.958071
       yield |      1.04    0.960586
        ferc |      1.03    0.970407
-------------+----------------------
    Mean VIF |      1.05
```

. hettest, rhs

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
       Ho: Constant variance
       Variables: seedc laborc ferc pesc otherc yield

```
            chi2(6)      =       5.90
            Prob > chi2  =     0.4350
```

## 3. **3R3G model**

```
 reg net seedc laborc ferc pesc otherc yield  if RG==1

      Source |       SS       df       MS              Number of obs =     144
-------------+------------------------------           F(  6,   137) =   12.18
       Model | 7.5017e+14       6  1.2503e+14           Prob > F      = 0.0000
    Residual | 1.4062e+15     137  1.0264e+13           R-squared     = 0.3479
-------------+------------------------------           Adj R-squared = 0.3193
       Total | 2.1563e+15     143  1.5079e+13           Root MSE      = 3.2e+0
> 6


------------------------------------------------------------------------------
         net |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       seedc |   2.090534   1.349591     1.55   0.124    -.5781888    4.759257
      laborc |  -1.021794   .5608093    -1.82   0.071    -2.130756    .0871678
        ferc |  -.617501    .3465655    -1.78   0.077     -1.30281    .0678084
        pesc |  -.353227    .7992242    -0.44   0.659    -1.933638    1.227184
      otherc |  -1.000253   .3926553    -2.55   0.012    -1.776702   -.2238043
       yield |   1945.275   266.2946     7.30   0.000     1418.696    2471.854
       _cons |  -265498.4    2441814    -0.11   0.914     -5094018    4563021

 ovtest, rhs

Ramsey RESET test using powers of the independent variables
       Ho:  model has no omitted variables
             F(18, 119) =       0.55
                Prob > F =      0.9266


. vif

    Variable |       VIF       1/VIF
-------------+----------------------
      laborc |      1.18    0.849722
       yield |      1.12    0.890491
        ferc |      1.08    0.924265
      otherc |      1.06    0.942199
       seedc |      1.06    0.942581
        pesc |      1.05    0.953621
-------------+----------------------
    Mean VIF |      1.09

hettest, rhs

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
       Ho: Constant variance
       Variables: seedc laborc ferc pesc otherc yield

       chi2(6)      =      74.92
       Prob > chi2  =     0.0000
```

# INCOME DIVERSIFICATION FOR HOUSEHOLDS IN THE MEKONG DELTA

**Huynh Truong Huy**
**Le Tan Nghiem**
**Mai Van Nam**

# 1.  INTRODUCTION

Diversification is a common phenomenon in any livelihood strategy, especially in the agricultural sector which farmers are confronted regularly with market risks, disease, natural calamity etc. Hence, diversification in the farm production process is required to reduce risks and stabilize income.

In his book entitled "Rural livelihoods and Diversity in Developing Countries", Ellis (2000) indicated that diversification is necessary for farm household's income stabilization. He explains that diversification is affected by several factors such as the extent of risk reduction, realization of economics of scope, responses to crises and livelihood strategies. Households endowed with insufficient productive agrarian capital to absorb their full labor endowment also seek out off-farm or non-farm income sources (Barrett, 2001).

In rural areas of the developing countries, diversification in activities and income becomes even more necessary because of specific characteristics. High transaction costs induce many households to resort to self-provision in several goods and services. Increasing pressure of population often result in landholding being too small to absorb all of household's labor supply. Limit risk-bearing capacity and weak financial institutions also create strong incentives to select a portfolio of activities in order to stabilize income flows so as to stabilize consumption and minimize the risks. Responding to each of these factors, households often decide to choose a common solution: diversified employment and income patterns (Barrett and Reardon, 2001). This is also the reason to explain for the evidence that non-farm income share accounts for 42% in Africa, 40% in Latin America and 32% in Asia of total income (Reardon *et al*, 1998).

Since 1986, when Vietnam launched the "doi moi" policy of renovation, the socio-economic conditions have improved markedly for the majority of the population. The number of people living below the poverty line has been cut by half over the past ten years. Poverty incidence – measured by the international poverty line - has been reduced from 37.4% in 1998 to 28.9% in 2002. Social services have remarkably improved and the economy in general continues to grow at a high rate, reaching an average growth in GDP over 7% since 2002. In addition, economic reform policies – such as trade agreements – show that Vietnam is committed to integration into the world market including EU, ASEAN, and most recently the U.S. That leads to significant changes in the structure of Vietnam's economy as illustrated in Figure 1.
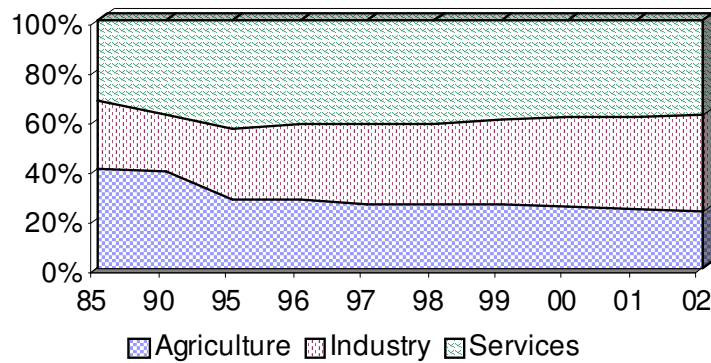
**Figure 1.    Change in structure of economy in period 1985 - 2002**
*Source: Vietnam GSO, 2003*

The Mekong Delta plays a very important role in the socio-economic development strategy for Vietnam. It is the main granary in Vietnam, not only ensuring national food security but also a main source of export goods, especially rice and fishery products. With its potential of agricultural production, the Mekong Delta has contributed about 50% of Vietnam's total rice output, 90% of total rice exports, 65% of total seafood, and 70% of total fruit as well. Its gross domestic product (GDP) grew by an average of 9.6% annually in 2001-2004, which was above Vietnam's average.

Now, population of the Mekong Delta is nearly 17 millions, accounting for 21% total population of the whole country, of which 66% of residents are living in rural areas and participating in agricultural sector. Average agricultural area per capita and worker is 1,792m$^2$ and 4,793m$^2$ respectively (Vietnam GSO, 2002). The economy of the Mekong delta is still dependent on the agricultural sector with its share of 30% in 2002 compared to 38% in 1999 (excluded forestry and fishery). Furthermore, in recent years the speed of industrialization is rapid and industrial growth has reached at 20% per year leading to an important change of manufacturing in the economy of this region. (see Annex 1).

Fostering diversification, of food and agricultural production diversification based on the effective exploitation of natural resources and adapted to the socio-economic conditions of the area is one of the most strategic decisions of the Mekong Delta to improve household income and to protect the ecological environment.

In the Mekong Delta, some less attractive traditional production activities have pushed rural labor to seek income from other sources. It is found that 45.5% of the agricultural labor force in this area are engaged in supplementary activities due partly to the insufficient income from the main source (Nghiem, LT et al, 2003). Moreover, development of industrial zones in provinces of the region attracts a great deal of labor force. That makes a potential opportunity for farmers to shift from agricultural to non-farm activities.

Therefore, this paper explores income diversification as a productive strategy of farmers in current context in the Mekong Delta as well. First, it looks generally at the farmer's resource capacity in the production process and degree of production diversification. Then, it considers factors influencing activity diversification and income. Finally, it will indicate consequences and constraints from the income diversification.

The aim of this study is to gain more insight into the pattern of income diversification of farm households in the Mekong Delta as well as to point out constraints on diversification.

More specifically, the objectives of this study are:
- Giving a general description on the farm household characteristics and their patterns of diversification at each of various ecological region;
- Measuring the extent of income diversification and determinants of income of the farm households;
- Identifying constraints facing farmers in diversifying into non-farm activities and wage-labor.

This study includes the following sections, first one reviews of the main theoretical literature on income diversification and a summary of findings from previous relevant researches. Section 3 presents the theoretical framework and the methodology including relevant concepts and the description of several internal and external environmental factors affecting decision of household in income diversification strategy. Section 4 describes the data description, of which, the targeted studied site was based on distinct ecological characteristics of the Mekong Delta, namely fresh-water, flooding, coastal site and urban area. Moreover, situation of income diversification of households is also descriptively analyzed through the collected data. Section 5 shows the result and discussion of household income and some findings are summarized in the conclusion section.

## 2.    THE LITERATURE REVIEW

### 2.1.    Theoretical literature of the study

The term "diversification" has been defined and explained in variety of ways. Usually, diversification refers to an increase in the number of sources of income and the relative importance of different sources. Thus, a household with two sources of income may be more diversified than a household with just one source. In addition, a household with two sources of income, each contributing 50% of the total, would be more diversified than a household with one source accounting for 90% of the income (Joshi, 2003).

A second definition of diversification concerns the switch from subsistence food production to the commercial agriculture. Delgado and Siamwalla (1997) argued that farm diversification as an objective in African smallholder agriculture should refers primarily to the part of farm household output undertaken specifically for

cash generation. This could be considered as agricultural commercialization. For example, a farmer may move from producing various grains, vegetables for own consumption to specializing in one or a few cash crops.

A third definition of diversification focuses on switching from low-value crop production to higher-value crops like livestock, fishery, or non-farm activities. This type of diversification is described as an increase of return of per planted land for the farm household.

It is recognized really that diversification is often associated with a change of economic structure in both regional and national level. For example, in Vietnam the contribution of agriculture to GDP has declined from 35.3% in 1991 to 21% in 2000 and 20.9% in 2005 (Vietnam GSO, 2005).

Household motives for diversification, as well as their opportunities differ significantly across settings and income groups, suggesting an important distinction between: (1) diversification undertaken for accumulation chances, driven mainly by either activities with higher value or income; and (2) diversification undertaken to manage risk, cope with shock, or escape from agriculture in stagnation or in secular decline (Thomas Reardon; Julio Berdegué; Christopher B. Barrett; and Kostas Stamoulis, 2006).

Farm households engage in diversifying their portfolio of activities in order to improve their living standards and manage risk. According to Ellis (1998), income generation is one of the main components of livelihood strategies. Further, natural and policy induced risks are facts of life for many people all over the developing world where insurance and credit system are weak or nonexistent. So, households intend to use income diversification as a form of pre-risk management or to cope ex post with external changes that have occurred (Reardon, Delgado, and Malton, 1992).

The literature on livelihood sustainability under conditions of economic uncertainty concludes that most households avoid an extended period of dependence on only one or two sources of income (Reardon, 1997).

In rural areas of developing countries, diversification into non-farm income sources is growing over time and now accounts for a considerable share of household income. Many studies that were conducted in rural Africa by Barrett, Reardon and Webb (2001); Barrett, Mezunch and Aboud (2001); Block and Webb (2001) found a positive correlation between non-farm diversification and household welfare. On the basis of these findings, recommendations such as the promotion of off-farm employment in rural areas as a policy tool have gained widespread support by the development agencies, including the World Bank and non-governmental organizations (Delgado and Siamwalla, 1997).

Migration of family members – local and international – is a widely used diversification strategy with remittances not only supplementing family income but also stabilizing and reducing risks. In Asia, local non-farm income is typically much more important than migration remittances except in the few countries

where international migration has become extremely important (the Philippines) and rural-urban migration has grown extremely rapidly.

## 2.2.    Empirical literature relevant to the study

This part reviews the empirical studies on factors influencing household income diversification. As mentioned before there are numerous studies of income diversification in the context of developing countries. However, in the scope of this study, only some selective findings are reviewed.

Reardon (1997) summarized the results of 27 studies of rural non-farm employment in sub-Saharan Africa. He found that non-farm activities are relatively important in rural areas, accounting for 30-50 % of income in many cases. In general, non-farm wage labor is more important than non-farm self-employment. Non-farm rural income tends to be more important in areas near by cities which have good infrastructure and high population density. Finally, non-farm income is more important among better-off rural households.

Delgado and Siamwalla (1997) examined patterns of income diversification in Asia and Africa. They noted that African farmers often have highly diversified crop mixes as a strategy to reduce risks associated with bad weather. In many Asian countries, crop diversification is associated with reducing the importance of rice and moving toward fruits, vegetables, and livestock activities. This type of diversification raises income but exposes farmers to market risks, particularly when the commodity is perishable. They argued that governments could play a constructive role in facilitating institutions, such as cooperatives and contract farming that facilitate diversification into high-value commodities, thus raising rural income.

The study focuses on the patterns of diversification in Vietnam. Pederson and Annou (Minot, N et al, 2003) examined the patterns of diversification using the 1992-93 Vietnam Living Standards Survey - VLSS[14]. They found that agricultural diversification (defined as the share of non-rice output in agricultural output) is associated with small farms, small-irrigated areas, and higher levels of education. In addition, they found that households who are relatively specialized in rice tend to diversify by engaging in non-farm activities extending non-farm income. This may suggest that household prefer some form of diversification, either in non-rice production or in non-farm activities.

Block and Webb (2001) identified the factors determining income diversification in Ethiopia. Based on panel data from two surveys (1989 and 1994) on 300 households, the authors studied the correlation among income diversification, household perceptions of livelihood risks, and changes in consumption outcomes across two points in time in post-famine in Ethiopia. A log-linear regression

---

[14] This survey was conducted by the Vietnam's General Statistical Office (GSO) with financial assistance from the United Nation Development Program (UNDP), the Swedish International Development Agency (SIDA) and technical assistance from the World Bank (WB).

model was applied to estimate income diversification as a function of income per capita, household's resources, and scale. In this model, the crop share of total income measures the extent of income diversification. Its findings as follows:

- There was a strong evidence that income diversification is positively associated with age of household's head.
- Higher income was positively associated with greater diversification away from crop production.

Escobal (2001), Peru, revealed that non-farm activities made up roughly half of all rural income, though the percentage varies widely across regions and households. The share of income from non-farm enterprises was positively correlated with education, electrification, proximity to market, and the value of crop output per hectare.

Joshi (2002) examined the trends in diversification in South Asia using area and production statistics and the Simpson Index of Diversity (SID). They show that the diversity of crop production has increased over the past two decades in most South Asian countries. In India, the southern and western regions are diversifying away from grains toward pulses, oil seeds, fruits, and vegetables. In the northern region, farmers are turning from coarse grains to commercial production of rice, wheat, and (to a lesser degree) non-grain crops. The eastern region is poorer and less developed. Agriculture is dominated by rice, but the non-rice areas are quite diverse. Carrying out state-level time-series econometric analysis, they show that diversification is associated with road density, urbanization, average farm size, and per capita income.

Henin (2002) provided a description of diversification patterns in the Northern Uplands of Vietnam, focusing on Lang Son province. He argued that "doi moi" policies have increased income and stimulated income diversification. Farmers in the study area have adopted modern rice varieties and fertilizer (though they continue to use local varieties as well) and have expanded production of cash crops such as sugarcane, peanuts, soybeans, tobacco, cinnamon, and tea. Non-agricultural activities are limited by the lack of rural industries, but some households earn income from porter work, collecting firewood, bicycle and motorbike repair, and so on. Farmers identify a number of constraints to diversification and poverty reduction: lack of capital, shortage of paddy land, poor access to markets, poor irrigation infrastructure, and low quality education.

From the findings of these studies above, it is recognized that most authors emphasized virtually on the importance of wage labor in non-farm activities contributing to the income of farm household, mentioned determinants of diversification, and pointed out some constraints that household have confronted with.

In short, the theoretical and empirical literatures in this section have some limitations. First, most authors examined income diversification in rural areas as the simple way to improve livelihood and avoid risks due to seasonal factors, market failure, and natural calamity. Second, the share of non-farm income was

considered as a factor of income diversification. In fact, income diversification is farm household's behavior in deciding to allocate their resources aimed to stabilize income and decrease risks in the production process. Further, there is little or no research dealing with consideration of income diversification between various ecological regions in Vietnam and Mekong Delta as well.

Previous theoretical and empirical research offers a framework for studying income diversification for this study, which will focus on income diversification taking into account different natural ecological and economic clusters in the Mekong Delta, Vietnam.

The research questions of this are:

1. What is the pattern of income diversification among rural households in the Mekong Delta of Vietnam?
2. Does the pattern of income diversification differ between natural ecological regions?
3. What are determinants of household income in the studied sites?

# 3. THE THEORETICAL FRAMEWORK AND METHODOLOGY

The theoretical framework of income diversification of household is described by several factors in according to both internal and external environment of households. These factors which include availability of resources, access to market or credit, seasonal influence, environment of policy, culture, society etc. can affect household decisions on the pattern of income diversification (Ellis, 1993).

## 3.1. Some relevant concepts

According to Ellis (1993), a farm household is defined as "households which derive their livelihoods mainly from agriculture, utilize mainly family labor in farm production, and are characterized by partial engagement in input and output markets in which are often imperfect or incomplete". Hence, in this research, a farm household is defined as a that either engages in farming production including both farm and non-farm activities.

Farm household's income is measured by the sum of income derived from both farm (crops, livestock, fishery, forestry) and non-farm activities. Therefore, farm income is respectively the total income earned from farm activities and non-farm income refers to total revenue derived from all the non-farm activities. Non-farm income consists of wages, remittance from relatives, interest from saving accounts and other transfers from the government.

Income diversification refers to the situation in which households allocate their resources in a portfolio of several activities. For Barrett and Reardon (2001), "diversification is widely understood as a form of self-insurance in which people

exchange some foregone expected earnings for reduced income variability achieved by selecting a portfolio of assets and activities that have low or negative correlation of income". In addition, Ellis (2000) also defined livelihood diversification as the process by which rural household constructs an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living.

It is found that the ultimate goal of livelihood diversification is to improve income and the standard of living. Therefore, livelihood diversification and income diversification may be used interchangeably as they have the same meaning.

## 3.2.    Theoretical framework of income diversification of household

Ellis (2000) classified the reasons causing individuals and households to pursue diversification as a livelihood strategy based on the two main motives namely necessity versus choice. An alternative formulation is to classify determinants as "push" and "pull" factors (Barrett and Reardon, 2000). "Necessity refers to involuntary and distress reasons for diversifying and by contrast, choice refers to voluntary and proactive reasons for diversifying" (Ellis, 2000). Such categorizations are not mutually exclusive as determinants of diversification, they constitute distinct but overlapping forces and process leading to diversification.

### 3.2.1. Availability of resources

Availability of key assets (such as savings, land, labor, education and/or access to market or employment opportunities, access to common property natural resources and other public goods) is an evident prerequisite in making rural households and individuals more or less capable to diversify (e.g. Dercon and Krishnan 1996; Abdulai and Crole Rees 2001). Investment of a proper mix of the above endowments is the starting move of any independent activity.

Moreover, labor capability and education determine the capability of finding a job. Accumulated savings are often needed to migrate to overcome the cost of moving. Beside, environmental deterioration can be indeed important drives towards diversification, and economic and political shocks are often a major reason for migrate.

### 3.2.2.   Seasonality in crop production

All rural households face seasonality as an inherent feature of their livelihoods (Ellis, 2000). Seasonality, from an economic point of view, means that returns to productive assets vary across time, across individuals within a household, or across households within a community in both farm and non-farm sectors. Households react to the variation in returns by exhibiting diverse activities and income (Barrett and Reardon, 2001). For example, if a member has a special skill for metal working, pottery, or some other skill-based trade, the household may let him

specialize using his skill and other members of the household to engage in less uniquely skilled occupation.

### 3.2.3.   Risk and coping with risk in livelihood diversification

Many neoclassical economists have developed theories on household economics, but some of them, i.e. Barnum-Squire, Low, assumed that there is no risk and uncertainty. In reality, however, risk is relevant and so, Ellis (2000) took risk into account in his study on livelihood diversification as a determinant of pattern of income diversification. Risk management is a factor to take into account to explain diversification behavior (Chambers 1997, Reardon 1992, Bryceson 1996; Ellis 2000; Hussein and Nelson 1999). The basic logic of this argument is that previous experience of crop or market failure can provoke diversification as a means of spreading perceived risk and reducing the impact of total or partial failure on household consumption. The argument entails that diversification often requires choosing the second best income-generating alternative: risk-averse farmers perceive the amount of income given up by diversifying income sources as less important than the reduction of the total failure hazard. In this perspective, risk management through diversification complements and counterbalances the above principle of maximization of return per unit of labor.

In agricultural sector, if a farmer decides to cultivate only one crop (like paddy), when the price or the yield of this crop fluctuate, his income may be threatened more than household with more than two types of crop (like paddy, bean). Therefore, a farmer can stabilize his total revenue by diversifying in many ways. For example, some households can change from low-value crops to higher-value crops. In addition, non-farm activities are usually considered as less risky than in agricultural ones and hence endowments and efforts are switched from farm activities to non-farm activities. The relation between various factors involved in livelihood diversification in the following diagram:
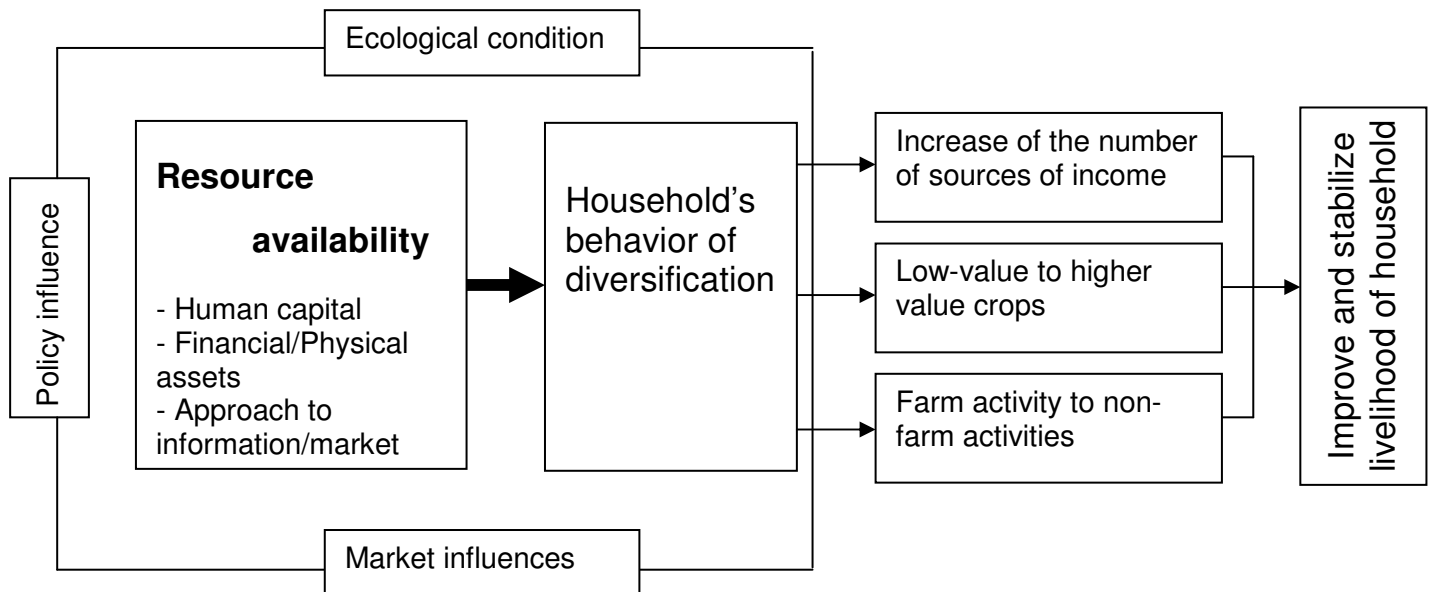
**Figure 2. Theoretical framework of household's income diversification strategy**

In conclusion, this section has presented the theoretical framework and relevant concepts on income diversification. It provides a background of model specification to estimate the determinants of farm household income and income diversification.

### 3.3. Methodology and model specification of the study

We can now provide a model of farm household's income, with the aim to identify the factors influencing farm household income diversification in different ecological sites in the the Mekong Delta of Vietnam

3.3.1. Classification of farm household's income

For farm households in the selected villages, income comes from a range of sources. This study distinguishes the following main sources:

(1) Income from cash crop;

(2) Income from husbandry or mainly net income of raising pig;

(3) Income from fishery sector mainly shrimp, crab and fish;

(4) Income from salary or wage or total earnings from hiring out of farm and non-farm sector;

(5) Income from self-employment or the net return from doing own business;

(6) Income from non-labor or total remittances from relatives, interests from banks or social aid.

Apart from these income sources, the farm household's income may be derived from other extraordinary sources like selling land or valuable things or lottery winning. However, the collected data in the studied sites is only available for these sources of income that will be used to measure the income diversification level by Simpson index. (see below)

270

### 3.3.2. Measurement of income diversification

Different measures of income diversification are proposed in the literature. Block and Webb (2001) used the share of total income per capita derived from crop production. They argued that the smaller this share the more diversified farm household income. However, this measure is rather poor as it does not take into account the variety in the sources of income. For example, a household specialized in one specific (perhaps very risky) non-farm activity but without any farm income, would have a fully diversified income as its share of farm income would be zero.

Obviously, income diversification does not depend only on the share of crop production but also the number of different income sources. A Herfindahl index[15] - as suggested by Barrett and Reardon (2001) - includes both the number of income sources and the distribution of total income among these sources. A Herfindahl number of one would imply zero diversification whereas a Herfindahl number if zero would correspond with full diversification.

An index which the algebraic complement of the Herfindahl index, but more widely used in biology to measure the bio-diversity of an eco-system is the Simpson index or

$$SID = 1 - \sum_i P_i^2$$

*where* $P_i$ is the proportion of income coming from source i.

If a household specializes in a unique activity ($P_1 = 1$), then the resulting SID will be zero. A fully diversified household would have a large number of very small shares and SID approaches one.

In this study the Simpson index is used as a measure of income diversification, similar to Joshi (2003) who applied the Simpson index to compare crop diversification in several South Asian countries.

### 3.3.3. Determinants of farm household's income

Income diversification affects livelihood's stability and overall welfare of farm households. The level of and type of income diversification depend virtually on the accessibility and availability of different income sources and kinds of risk that households are responding to, which may in turn depend on household's geographic condition, access to factor and labor market. Empirical studies estimated in term of the ordinary least square (OLS) showed that educational attainment and infrastructure access are strong determinants of diversification (Barrett, Reardon, and Webb 2001; Barrett, Bezunh, and Aboud 2001; Block and Webb 2001). In addition, Nghiem L.T (2003) also indicated that there was a

---

[15] Herfindahl index = $\sum s_i^2$, where: *i* refers to all income source and *s* represents the share of each income source

significant relationship between the household's income and factors such as labor ratio, land size, level of diversification, access to credit, and willing to respond risks (dummy variable).

Based on these empirical studies and the available data, we attempt to estimate factors influencing the farm household's income by a log-linear regression model in which the household's income is a function of household characteristics and its model specification is represented in detail at below.

- Income: refers to the farm household's total income, which is the sum of six sources of income classified in sub-section 3.3.1, and estimated in thousands of Vietnamese dong (VND).
- Rate of labor in household: refers to the number of members of working age in the household. Working age is considered as 14 to 65. The remaining household members are considered dependents. In addition, labor is considered an important input of productive activities, especially in the agricultural sector, which is more labor intensive (according to Nghiem L.T, 2003). The amount of labor is directly proportional to the volume of activities conducted by landless households, as they have to engage in many income generating or non-farm activities. Thus, the relationship between a household's income and labor factors are terms of either a negative or positive sign.
- Land: measures the total land area used for agricultural production. This includes crops, husbandry, and aquaculture. In addition, land is considered an indispensable factor of agricultural production as large land area allows a household to diversify into many crops and derive a more stable income.
- Education: this measures the highest level of education of the head of the household.
- Number of income sources: counts the number of income-generating activities that the household is engaged in. These activities are classified in sub-section 3.3.1. There is a relationship between the diversification level and the amount of activities, which can be measured using the Simpson index (SID). The SID approaches one as the number of activities increases.

**Table 1. Summary on the estimated variables of the model of farm household's income**

| Variable | Symbol | Definition | Unit | Expected sign |
|---|---|---|---|---|
| Household's income (dependent variable) | Income | The sum of all income sources of household | Thousand of VND | |
| Rate of labor | Labor | The rate of labor in the household | Head | + |
| Land size | Land | Total land area of the household | $1,000m^2$ | + |
| Educational standard | Education | Years of schooling that HH's head attended | | + |
| Number of income sources (SID) | Activity | The number of income sources that HH have derived | | + |

# 4. DATA DESCRIPTION OF THE STUDY

The data set used in the study was collected from two main sources namely the primary data from a field survey of 201 farm households in the selected sites and the secondary data gathered from semi-structure interviews, group discussion, related documents and summary reports. Here, we will represent in detail the data description of the study as follows.

## 4.1. The primary data

As one of the objectives of the study is to analyze income diversification differences in the context of various ecological natural conditions in the Mekong Delta, a field survey of the farm households was conducted in 12 communes out of 4 provinces in the Mekong Delta, representative of various specific ecological conditions.

The Mekong Delta is usually classified into main ecological and economic clusters namely urban, flooding, fresh-water, and coastal sites. Stratified sampling was used for the survey with the main following steps. Firstly, 4 provinces were selected to be representative for various ecological conditions. Secondly, 3 communes out of each province were chosen by levels of income per capita including high, middle and low. Thirdly, 15-20 households were selected to interview in each specific commune. Overall, the survey of 201 households was conducted.

**Table 2.      Description of household survey**

| Province | Surveyed district | Sample size | Ecological condition | Types of data collected |
|---|---|---|---|---|
| An Giang | Chau Thanh | 50 | Flood | Household characteristics, income generating activities, resources of household in income diversification process, and external influences involved. |
| Can Tho | O Mon | 51 | Urban | |
| Tien Giang | Cai Be, Cai Lay | 51 | Fresh-water | |
| Soc Trang | Vinh Chau | 49 | Coastal | |

*Note:    In addition, the MD is also divided into four clusters based its socio-economic pattern including urban, fresh-water, flood, and coastal site.*

## 4.2.   The secondary data

Apart from the field survey data, this study also uses secondary data collected mainly from official statistical reports by Provincial General Statistical Offices, annual summary reports in order to describe an outlook of economic indicators as well as income sources of each provincial site in the Mekong delta. In addition, methods of semi-structure interview and group discussion with local officials are executed to identify and assess the socio-economic situation and the process of income diversification for farm households in the selected sites. The strength of the methods is to help us have a general outlook over the situation of production and income generating activities for the farm households in the various ecological regions. Further, the discussion with local officials provides us information about the oriented plans on production development and strategy for improving income by means of generating non-farm activities to the landless households.

**Figure 2.    Map of Mekong Delta, Vietnam**

*Source: http://cantho.cool.ne.jp/ameder/map/blank6.gif*

### 4.3. Outlook of agricultural production in the Mekong Delta

The Mekong Delta is one of the 7 key economic regions of Vietnam, located at the South-West of Vietnam, which has a potential natural condition suitable for agriculture and fishery. This region has about 4 million ha of crop cultivated land of which more than 90% of the total (about 3.8 million ha) is paddy cultivated area. The interlacing network of rivers and canals offer ample opportunities for developing multicultural agricultural models combining cultivation of livestock, fishery and forestry.

Despite the good conditions for agricultural production, land is at a premium. For households depending only on crop production and toiling small plots, it is impossible to escape poverty. In addition, the infrastructure of rural areas is poor which makes them uninteresting for manufacturing enterprises and alternative labor use. Therefore, households cannot find any non-farm work to improve their livelihood during leisure time after crops.

### Used land for production

The Mekong delta is famous as the largest and most fertility delta basin not only of Vietnam but also other countries in the South East Asia. In this delta, there are specific characteristics of a dominant warm tropical basin possible for agriculture and fishery.

The statistical yearbook of the Mekong Delta showed that cultivated land areas in general and paddy land in particular has been reduced from 3,945 thousands ha in 2000 to 3,785 thousands ha in 2003, while other crops and fishery breeding lands increased due to their higher productive efficiency. In addition, natural

forest area was reduced remarkably in the past two decades, while planted forest area is increasing. Especially in 1980, natural forest area was 230,500 ha, planted forest area was 23,300 ha. But coming to the year 2000, natural forest area was reduced to 81,500 ha and planted forest area was increased 256,000 ha (Binh, N.T, 2005).

**Production system and main agro-products**

*Crop*: The Mekong Delta has a diversified natural condition and potential for developing many kinds of crop like: food, fruits and vegetables. Paddy is the main crop and essential for national food security and exports since 1990 until now. In general, paddy is usually cultivated in 2 – 3 crops depending upon various ecological condition of each region. The winter-spring crop always gain the highest yield with 5.43 ton/ha. In recent years, many agricultural production models were adopted as an alternative for the paddy monoculture such as paddy-shrimp, paddy-fish or 2 paddy crops-1 vegetable crops etc. Apart from paddy crop, some high land regions specialize in fruit crops like pomelo, mango, orange, longan, rambutan.

*Husbandry*: there are many advantages of natural and feed resources, husbandry in the Mekong delta has grown considerably with main stocks consisting of pig, cattle, chicken and duck. Especially the stock of pigs increased in recent years because of its relatively stable price. Raising pigs is also a traditional activity of rural households, especially when women have spare time.

The number of buffaloes decreased notably from 124,600 heads in 1995 to 35,800 in 2003. Buffaloes are traditionally used to plough paddy fields, but are gradually replaced by tractors as this increases farmer productivity. At present, buffaloes are kept for consumption *(see Annex 3)*.

Poultry – chicken and ducks - are mostly kept for personal consumption but some households keep them for selling. However, in two recent years, a large number of poultry was destroyed due to prevent further spread of bird flu. The present number of poultry was reduced drastically but the present size of the remaining stock is not precisely known.

Fishery in the Mekong Delta, especially coastal and inland sites, is a prioritized sector for development in recent years. Millions of people are dependent on aquatic resources, directly or indirectly, for their livelihoods in coastal areas. Take An Giang as a example evidence in which produce about half of the fish output of the whole region with about 5,000 households involved. According to official employment statistics, one out of twenty-five persons (approximately to 3 million of people) in Vietnam engages into the fishery sector.

## 4.4. Income sources of the farm household in the Mekong Delta

Agriculture and fishery continue to make up a large share of the regional economy structure. Rice farming remains a leading sector in order to ensure high productivity, high product quality, and also national food reserves. In 2004, rice

276

production harvested 17.5 million metric tons, of which 7 million metric tons was exported. Aquaculture has also become a leading sector. About 600,000ha of unproductive crops, which accounted for 20 % of total agriculture-forestry-fishery area, has changed to farming seafood. Farmed seafood and natural catches amounted to roughly 1.5 million metric tons; while, trading in breeding shrimp and fish, feed, and products have also developed. The delta is able to self-supply Tra and Basa (catfish) breeding fish and has 2,000 shrimp-breeding farms, which meet 50 % of the demand.

**Table 3.    Monthly per capita income classified by sectors and regions, 2002**

| Indicator | Unit | Whole country | Mekong Delta | Flooding site [a] | Fresh-water site [b] | Coastal site [c] |
|---|---|---|---|---|---|---|
| Income per head | 1,000. VND | 356.1 | 371.3 | 402.5 | 354.6 | 319.2 |
| *Of which*:<br>- Agriculture, forestry, fishery | % | 28.50 | 37.60 | 30.32 | 36.14 | 49.13 |
| - Non-agriculture, forestry and fishery | % | 22.63 | 23.65 | 30.19 | 22.26 | 17.89 |
| - Salary, wages | % | 32.69 | 24.97 | 23.65 | 28.20 | 21.60 |
| - Others | % | 16.20 | 13.82 | 15.84 | 13.41 | 11.38 |

*Source: Vietnam GSO, 2003*

[a]    *includes Dongthap province, Angiang province and, a part of Cantho city.*
[b]    *includes provinces like Longan, Tiengiang, Vinhlong, Bentre, Kiengiang, a part of Cantho;*
[c]    *includes Travinh,, Soctrang, Baclieu, Camau*

## 5.    EMPIRICAL RESULTS

### 5.1.    Resources and production diversification

The result of the 201 household survey provides the general description on the household's characteristics as in Table 4. Number of respondents is relatively balanced in the various provinces. In the Mekong Delta, there are 4 main ethnic groups consisting of Kinh, Khmer, Chinese and Cham; 196 respondents in the surveyed provinces are dependent virtually on the following ethnic groups: Kinh (78.10%). Chinese (7.10%) and Khmer (14.80%) who live scattered everywhere. Of which, rate of the Khmer and Chinese out of total population in Soc Trang is higher than other provinces in the region. There is the difference in diversification among ethnic groups. For instance, the Kinh often diversify by looking for a long-term non-farm activity; the Khmer prefers to look for temporary, seasonal works; whereas, the Chinese usually do business as a way of income diversification like convenient store, bakery.

For the educational standard of the 197 respondents, the result showes that rate of illiterate occupied at 12.7%. Most of household's head asked who only completed the primary school at rate of 41% of the total. According to the statistical data, the educational standard of people in the Mekong Delta is usually lower than other regions in the whole country. Because this region has a favorable natural and resource abundant in production and income generation in resulting to most of people have a tendency of leaving out of school as they are in age of schooling. Especially to Soctrang, 31.30% of the respondents, who are illiterate, are the highest proportion compared to other provinces due to limit of infrastructure, far away from school. Coming from the limitation of education, these respondents face much of constraints in looking for non-farm activities as mentioned by Reardon (1997) and Henin (2002).

**Table 4.     Some household's characteristics by provinces**

| Indicator | Unit | MD | An Giang | Can Tho | Soc Trang | Tien Giang |
|---|---|---|---|---|---|---|
| Sample | HH | 201 | 50 | 51 | 49 | 51 |
| Ethnic Group | HH | 196 | 50 | 50 | 48 | 48 |
| Kinh | % | 78.10 | 100.00 | 100.00 | 12.50 | 97.90 |
| Chinese | % | 7.10 | 0.00 | 0.00 | 29.20 | 0.00 |
| Khmer | % | 14.80 | 0.00 | 0.00 | 58.30 | 2.10 |
| Educational Standard of HH's head | HH | 197 | 48 | 51 | 48 | 50 |
| Illiterate | % | 12.70 | 8.30 | 3.90 | 31.30 | 8.00 |
| Primary | % | 41.10 | 54.20 | 37.30 | 37.50 | 36.00 |
| Secondary | % | 29.40 | 25.00 | 29.40 | 22.90 | 40.00 |
| High school | % | 16.20 | 12.50 | 27.50 | 8.30 | 16.00 |
| Higher education | % | 0.50 | 0.00 | 2.00 | 0.00 | 0.00 |

*Source: From the survey data in Sep. 2005*

Apart from the household characteristics mentioned above, some descriptive indicators which concern with household's sources of income generate will be showed in Table 5. The survey shows that most of respondents own a plot size with a median of 0.4 ha (equal to 4000 m$^2$). Generally, plot size per household in the Mekong Delta is relatively limited. Table 5, shows the number of household's members with an average of 5 persons; with 3 out of 5 persons in the household are in age of working.

It is found that most of the household's members engaged in agricultural activity (nearly 3 persons) and the rest of the household's members engaged into other activities i.e. non-farm, work for salary. It is noteworthy that crop production is the most important source of rural income accounting for 37% of total household's income, the second largest contribution to the household's income is doing business in 21%, 14% from fishery. It should be noted that the data was

collected in time of the bird flu disease, which means that apart of income in the husbandry sector, represented in Figure 3, went down remarkably to only 8%.

**Table 5.      Household's income source based on resources**

| Indicator | Median | Minimum | Maximum | Std. Deviation |
|---|---|---|---|---|
| Land size (1.000m$^2$) | 4.00 | 0.02 | 18 | 4.22 |
| No of HH's member | 5.00 | 2 | 10 | 1.81 |
| No of HH's labor | 3.00 | 1 | 10 | 1.81 |
| Works for salary/wages | 2.00 | 1 | 5 | 0.95 |
| Agricultural work | 2.00 | 1 | 10 | 1.69 |
| Non-farm work | 1.00 | 1 | 6 | 1.12 |

*Source: the survey data in Sep. 2005*
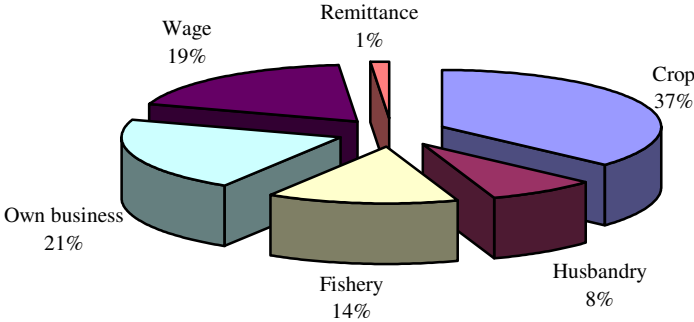


**Figure 3.** Importance of income sources among households (%)
*Source: From the survey data in Sep 2005*

## 5.2.  Income diversification under the natural conditions

This section investigates the pattern of income diversification as differing between various natural ecological regions?

**Income diversification in freshwater sites:**

Tien Giang and Can Tho are provinces representing this ecological type. Crop production in each province is different. Tien Giang is a leading province in fruit production in MD; most of households grow high valued kinds of such as mango, logan, papaya. Tien Giang has developed several important collected markets, fruits from here will delivery to other regions in the whole country and will even be exported to China.

Can Tho is the center of the MD, where household's cultivated land is limited (at averagely 4,700 m$^2$) so its economic development has become more diversified (see at Figure 4). Especially in recent years, some districts in Can

Tho like Omon, Ninh Kieu have developed an industrial sector and services. This is considered as an alternative for household's members in improving income.

**Income diversification in flooding sites:**
An Giang is one the provinces that have been influenced by the annual flooding season (from the middle of August to November) so that most of paddy fields have been obtained alluvial substance, resulting in an increase of paddy productivity. Moreover, in recent years, with investment in irrigation by local government, it has made it possible for some regions in An Giang to produce 3 paddy crops each year such as in Cho Moi, Chau Thanh.

In An Giang, people who live along canals and rivers have to comply with the Instruction No 04 (namely "Chi Thi 04") by the local government on prohibition of fishing in flooding season. This leads to a situation where fishing has been limited. Most households living there have received the supports of credit from local financial agencies and participated in training on non-farm activities aimed to help them change income generates from fishing to e.g. growing eel, handicrafts, on wage labor.

**Income diversification in coastal sites:**
In comparison with other provinces, Soc Trang has a favorable condition as a coastal area. It is found that more than 47% of household income was dependent on salt-water fishery; while this represented less than 6% in Can Tho, An Giang and Tien Giang. Some main aquatic kinds are shrimps, crabs growing. Beside, households can earn income from seasonal crops like vegetables (onion, cabbage) and fruits (logan, corn).
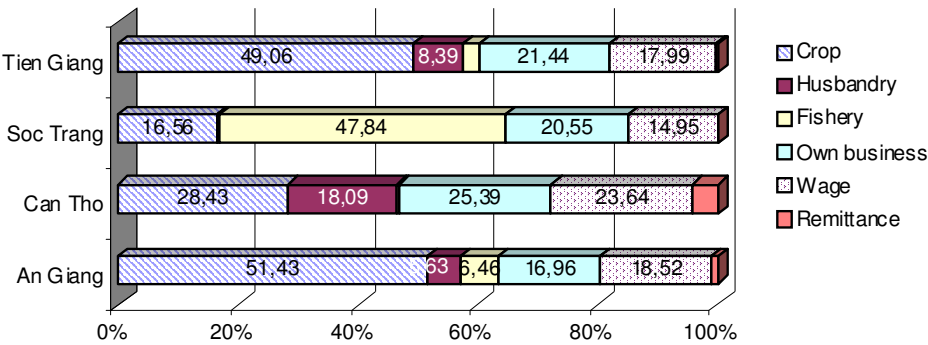


**Figure 4.** Distribution of income sources by provinces
Source: From the survey data in Sep 2005

The survey data show the diversification level of households based on their own resources like capital investment, cultivated land, labor force, skills, market reasons. In general, among 201 respondents, there are 51% of them engaged in

two activities, 27% in one activity, 18% in 3 activities and only 3% in 4 activities.

**Table 6.** **Number of source of income that households have derived**

|  | Number | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | 1.00 | 55 | 27.4 | 27.5 | 27.5 |
|  | 2.00 | 103 | 51.2 | 51.5 | 79.0 |
|  | 3.00 | 36 | 17.9 | 18.0 | 97.0 |
|  | 4.00 | 6 | 3.0 | 3.0 | 100.0 |
|  | Total | 200 | 99.5 | 100.0 |  |
| Missing | 0.00 | 1 | 0.5 |  |  |
| Total |  | 201 | 100.0 |  |  |

*Source: From the survey data in Sep 2005*

In general, level of participation in income generating activities among provinces is not really different, although they are dependent on various ecological conditions. Most respondents of the selected sites to engage in two income generating activities accounting for 51.5% of 200 respondents. The number of respondents who engaged in more two activities of income generation was about 21%. Can Tho is among the selected sites having the most highest rate of income diversification. The percentage of households participating in more than two activities in Can Tho was higher than that in others, accounting for 32% compared to an average rate of 17.4%, probably explained by Can Tho being the central city of region.

Analyzing data of households which have participated in a unique activity (27% of the respondents), it is found that the following constraints have affected the household's capacity of production diversification.
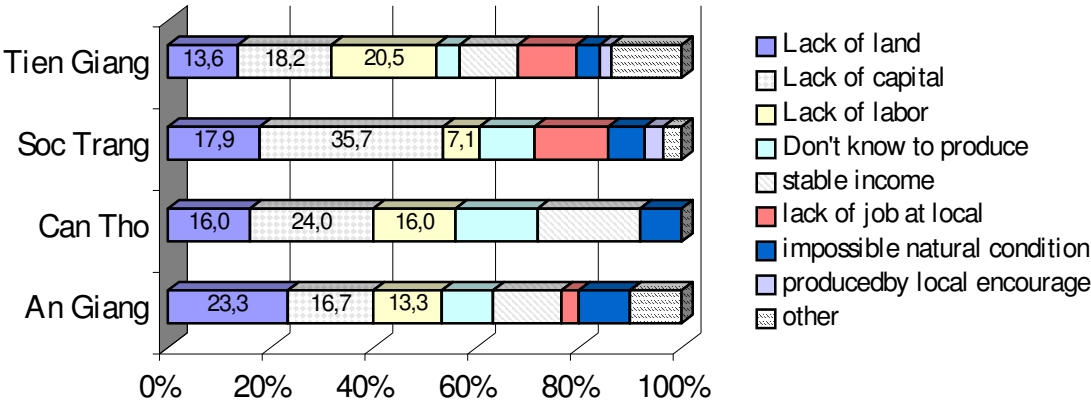


**Figure 5.** Reason why the HH engaged in one activity by province
*Source: From the survey data in Sep 2005*

Figure 5 shows a relation between production diversification and the capacity of household's resources for nearly 40% of the respondents capital investment and

land are among of the most important and indispensable inputs in making decision on diversifying or not.

Also lack ofe labor force in production is being a big problem in rural areas in the MD. The results of the study show that about 15% of the respondents mentioned this issue. Because, in the competition between rural and urban, labor has moved to the industrial zones or big cities or participated in labor export market with a higher income; according to Vietnam Statistics Yearbook 2003 income per capita in agriculture is only 640,000VND monthly, in comparison with 679,000 VND in fishery processing, and 900,000 VND in construction or services. However, apart from these issues mentioned above, some of the asked households devoted to one activity due to their own ability or they could not look for any work in rural areas; Tien Giang, Soc Trang are the clear examples of this, as found in the survey.

Figure 6 shows the main reasons why households could engage in more than one activity. The reasons are is not much different from the unique-activity households. Respondents also said that land and labor force are the important resources that are indispensable to enlarge or diversify crop production, and there are 24.83% of respondents who take into account this issue.

Further, the survey result points out the households in Can Tho and An Giang who have more advantageous conditions for generating income. Because, these provinces are considered as central to the MD region in socio-economic development, and the households can engage in many activities such as agriculture, non-agriculture or services. Simultaneously, they also indicated that production diversification is now one of the ways to decrease risk deriving from to market fluctuation, disease, or policy by local government. That means their resources will be invested into various activities for spreading potential risks.
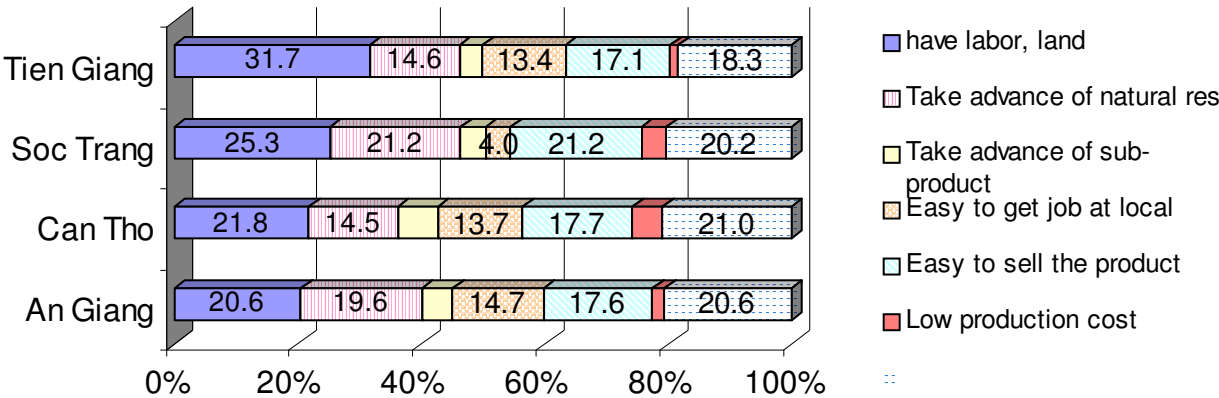


**Figure 6.** Reason why the HH engaged in many activities by province
*Source: From the survey data in Sep 2005*

282

In sum, analysis of the factors shows that households usually have to pay attention to their resources before making decision about income diversification. Land, capital and labor are important and necessary inputs for the households.

## 5.3. Measuring the extent of income diversification of households

This section shows the result of measuring the diversity of income source of farm household in the studied sites. The household income was divided into six categories as shown in Figure 3. From the analysis of 201 households, the SID indicator only reaches to 0.381 average (in comparison with 0.52 of 2002 VLSS in the entire region of Mekong delta). It is noteworthy to recognize that the income sources of households in the studied sites are less diverse than in the region; (reach to only 2.00 as compared to 4.91 numbers of income sources in the region). Can Tho is a leading province and has the highest diversification rate: 0.413. If the households have a larger endowment of resource, they can have opportunities to engage in more income generating activities (Nghiem, L.T, 2003). Although the average plot size per household in Can Tho is lower than that in others, due to the better educational standard these households can take advantage and exploit their own resource into doing business and service activities respectively.

**Table 7.     Some household's characteristics and SID indicator by province**

| Indicator | Unit | MD | An Giang | Can Tho | Soc Trang | Tien Giang |
|---|---|---|---|---|---|---|
| No of member in HH | Head | 5.00 | 5.00 | 5.00 | 5.00 | 4.00 |
| No of labor in HH | Head | 3.00 | 3.00 | 3.00 | 4.00 | 3.00 |
| Educational level | No of year of schooling | 5.00 | 5.00 | 6.00 | 3.00 | 6.50 |
| Land size | $1,000 m^2$ | 4.00 | 9.50 | 3.35 | 5.00 | 4.00 |
| No of income sources | Activity | 1.97 | 1.90 | 2.14 | 1.96 | 1.86 |
| SID | n/a | 0.381 | 0.359 | 0.413 | 0.365 | 0.384 |
| Total income of HH | 1,000VND | 27,600 | 40,150 | 21,900 | 29,600 | 20,550 |

*Source:     From the survey data in Sep 2005*
*Note:     rom analysis of the 2002 VLSS, the SID of the Mekong delta is 0.52 and number of income sources is 4.91.*

## 5.4. Determinants of the household income

This sub-section answers the third research question, namely what the determinants of the household income are? Of which, the household income from various sources is influenced by the household characteristics.

The log-linear regression model is used to examine the relationship between income and household characteristics. It estimates the change of household income by variation in some explanatory variables that include land size, number of labor, educational level, SID and share of agriculture in total income. The result of model shows as follows:

**Table 8.  Determinants of household's income estimated in log-linear regression model**

| Model | Coefficients | Standard Error | t-statistic |
|---|---|---|---|
| (Constant) | 7101,030 | 1968,893 | 3,607 |
| Rate of labor | 12210,147*** | 1701,486 | 7,176 |
| Educational standard | 1403,923* | 739,357 | 1,899 |
| Land size | 170,393*** | 62,275 | 2,736 |
| SID | 6031,159* | 3286,601 | 1,835 |
| Dependent variable | Household's income | | |
| Sample | 194 | | |
| R Square | 0.303 | | |
| Significant F | 0.000 | F = 19,855 | |

Source: From the survey data in Sep 2005
*Note: \*\*\*, \*\*, \* stand for the significance at 1%, 5%, and 10% respectively.*

As shown in Table 8, variation in household income is explained by the above variables with an R-squared statistic of 30.3% and a statistical significance of 0.05. Most of the independent variables are positive correlatively with household income. Rate of labor and land size are closely correlated with income at the 5% significance level. Obviously, land is among the most indispensable of inputs for the agricultural sector and the rate of labor is a decisive factor in household income. This is because labor is an extensive factor in the farming sector, thus if a household has a high rate of labor, they will have greater opportunity to participate in more activities with a higher expected income.

Household income is also explained significantly by the educational standard of the household and the SID variable. There is a positive correlation between the educational standard and SID at a significance level of 0.096. Thus, if the household has a higher level of education they are more likely to find employment with a higher relative income.

Beside, household income is also explained significantly by educational level and SID. Because, the education of household's head is a proxy for human capital and management skill (Minot, 2003). Barrett, Reardon and Webb (2001) argue that the educational attainment proves one of the most important determinants of non-farm earnings. So, it is not surprising that the educational level is correlated positively with household income. In addition, the results show that an increase of SID will contribute positively to the household income. This coincides with several previous studies and theory of income diversification. Generaly speaking, diversification is one of key ways to improve income for households.

Finally, there was not found significant influence of ecological conditions on household income in the study. Although the Krusal Wallis test on average

income in four ecological conditions shows that there is a difference in the household income among them at a significant level of 0.05.

### 5.5.  Constraints to the income diversification of household

One of the problems of crop diversification is damaged from flooding. Especially if paddy fields or fruits gardens are damaged, then farmers have to pay a lot of money for instance for renovating irrigation system as well as selecting new paddy varieties. To overcome such constraints, farmers usually use hybrid rice varieties with its duration below 90 days, or they apply improved farming method in order to shorten the duration of the crop.

Another constraint is that the labor force has moved to the big cities and industrial parks in the East of Vietnam for working for higher income. Further, labor export to abroad is developing in rural areas in the MD. This leads to the situation of lack of hired labor in rural areas.

Investment for production or doing business is also one of among the leading constraints to the households. They usually take the land use certificate to pledge as security for a loan. 36.6% of the respondents have got a loan from Bank for Agriculture and Rural Development. This leads to a big problem for landless households who may take "hot credit" with high interest rate from people around (18.8% of respondents in this survey). The next constraint for income generation is the lack of non-farm work in the rural areas. Soc Trang and Tien Giang are clear evidence for this situation. Because of limited rural infrastructure and transport mainly by river, these areas have not yet attracted much investors. Therefore, 32.6% of the respondents indicated the need for upgraded infrastructure like roads and clear water because these will help the household's members to have more opportunities for generating income.

As regards to marketing, most of respondents produced in small scale and their product were sold directly to traders or collectors at the household (equal to 57.7%). Other households took the products to local market for selling to the retailer. It is recognized that almost all products were sold unprocessed form.

## 6.  CONCLUSION AND RECOMMENDATIONS

This study examines patterns of income diversification in households in the Mekong Delta. Findings are based on the survey of 201 households in selected sites in various natural ecological and economic parts of the region. In addition, the study considers factors that determine the income of diversified households and identifies some constraints.

The results show that a household's decision to allocate resources is dependent mostly on the natural ecological conditions of their area. Thus, income sources and total income of households usually differ. In case of Tien Giang, An Giang and Can Tho, the share of crop income has reached to more than 50% due to

fresh-water based production. Tien Giang is famous for thousands of special fruit gardens such as mangoes, logans and green-dragons. Can Tho is located at the central position of region and has a good infrastructure. Consequently, households have many opportunities to diversify through switching from farm to non-farm activities. This is consistent with the summary of 27 studies by Reardon (1997) on rural non-farm employment.

Households living in flooded sites can gain additional income from rural non-farm activities such as handicrafts, wage labor, and fishery on a household scale. In coastal sites, it is really difficult for landless households to diversify as they can usually only gain additional income as hired labour for other households in the fishing industry or by migrating to industrial cities in the South-East such as Hochiminh, Binh Duong and Dong Nai.

The determinants of household income are presented in Table 8. They show that factors affecting the extent of household income diversification include the rate of labor, land size, educational standard of the household head and SID. Agricultural production still plays a dominant role in the regional economy. If households have an abundance of labor and land, they will have an opportunity to participate in many activities such as multi-crop production, fishery, etc. However, if a household has little labor or land it is much more difficult. Dercon and Krishan (1996) and Abdulai and Crole Rees (2001) found that the availability of key-assets such as land, labor and education is requisite in order to make rural households and individuals more or less capable of diversification. In this study, it was found that nearly 50% of the 201 respondents considered the endowment of land, labor force and capital as indispensable factors for diversification.

Furthermore, empirical findings showed that household income is strongly correlated with the endowment of resources such as land size (in case of Soc Trang, An Giang) and the extent of diversification (in the case of Can Tho, An Giang and Tien Giang).

## 6.1. Recommendations

Cultivated land area has decreased due to urbanization and industrial development. Consequently, diversification is important in both the farm and non-farm sectors in order to create employment and improve income for households in rural areas.

In the agricultural sector, farming households can increase income by maximizing profit through diversifying their activities on the farm. Evidence shows that paddy based production households cannot enrich production due to market failure.

Therefore, households with large amounts of land should take advantage of diversification and use a mixed cultivated model aimed at alleviating the risks of disease, disaster and market fluctuation. Support for farm households in relation

to diversification should be provided by local agencies. This includes financial, technological and market information services.

In the non-farm sector, the results from several locations show that upgrading rural infrastructure is key for the generation of income for farming households. Rural road construction, electricity system development and clean water supply are necessary inputs in developing non-farm activities and services such as hired transportation, farming tool repairs and food processing on a small scale.

This study presented findings in relation to patterns of income diversification as well as the identification of the determinants of diversified household income. However, there are still the following problems to be examined in further research:

1. Patterns and impacts of income diversification on landless households in rural areas.
2. Impacts of migration on the income of diversified households.
3. Study of the efficiency of diversification on the income growth of households.

## List of abbreviations

| | |
|---|---|
| ASEAN | Association of South-East Asian Nations |
| EU | European Nations |
| GDP | Gross Domestic Products |
| GSO | General Statistical Office of Vietnam |
| HH | Household |
| $N_o$ | Number |
| SID | Simpson Index of Diversity |
| US | The United State |
| VLSS | Vietnam Living Standard Survey |
| VND | Vietnam Dong (local currency) |

# REFERENCES

Abdulai, A. and A. Crole Rees (2001). Determinants of income diversification among rural households in Southern Mali. *Food Policy*, 26: pp 437-452.

Barrett, C.B., M. Bezuneh and A.A. Aboud (2001). A Income Diversification, Poverty Traps and Policy Shocks in Cote d'Ivoire and Kenya. *Food Policy,* 26, 4: pp 367-384.

Barrett, C.B., Reardon, T (2000). Asset, Activity, and Income Diversifications Among African Agriculturalist: Some Practical Issues. *Project report to USAID BASIS CRSP*.

Barrett, C.B., T. Reardon and P. Webb (2001). Non-farm income diversification and household livelihood strategies in rural Africa: concepts, dynamics and policy implications. *Food Policy* 26: pp 315 - 331.

Bryceson, D (1996). Deagrarianization and rural employment in sub-Saharan Africa: a sectoral perspective. *World Development* 24, 1: pp 97-111.

Binh, N.T. "Diversification development of agricultural production based on sensible exploitation of natural resources and environment protection in the Mekong Delta region".

Block, S. and P. Webb (2001). "The dynamics of livelihood diversification in post-famine Ethiopia." Food Policy, 26: pp 333-350.

Chambers, Robert. (1997). *Whose Reality Counts: Putting the First Last.* London: Intermediate Technology Publications.

Dercon, S and Krishnan, P (1996). Income portfolios in rural Ethiopia and Tanzania: choices and constraints. *Journal of Development Studies* 32 (6), pp 850–875.

De Brauw, A., J. Huang, S. Rozelle, L. Zhang, Y. Zhang. 2002. The Evolution of China's Rural Labor Markets During the Reform. *Journal of Comparative Economics*, 30: pp 329-353.

Delgado, C.L and Siamwalla, A (1997). Rural Economy and Farm Income Diversification in Developing Countries. *MSSD Discussion paper* No. 20, International Food Policy Research Institute, Washington, D.C.

Ellis, F (1993). Peasant Economic: *Farm households and Agrarian Development*. Second Edition. Oxford University Press.

Ellis, F (1998). Household strategies and rural livelihood diversification. *Journal of Development Studies* 35 (1), pp. 1–38.

Ellis, F (2000), *Rural livelihoods and Diversity in Developing Countries*. Oxford University Press.

Escobal, J (2001). The determinants of nonfarm income diversification in rural Peru. *World Development*, Vol. 29, No. 3.

Fanny Ginor (1979). *Socio-Economic Disparities in Israel*. Transaction Publishers.

*General St*atistical Office, (2003). The System of National Account for Vietnam. Statistics Publishing House.

Henin, B (2002). Agrarian change in Vietnam's northern upland region. *Journal of Contemporary Asia* No 32 (1): pp 3-28.

Hussein, Karim and John Nelson (1999). Sustainable Livelihoods and Diversification. IDS *Working Paper* 69. London: Institute of Development Studies.

Joshi, P.K, A. Gulati, P.S. Birthal, and L. Twari (2003). Agricultural diversification in South Asia: Patterns, determinants, and policy implications. *Markets, Trade, and Institutions Division Discussion Paper* No 57. International Food Policy Research Institute. Washington, D.C.

Lohmar, B., S. Rozelle, and C. Zhao (2001). The Rise of Rural-to-Rural Labor Markets in China,. *Asian Geographer*, Vol 20 (1-2): pp 101-127.

Luat, N.V (2001). Crop diversification in Vietnam. FAO, *Crop Diversification in the Asia-Pacific Region Journal.*

Nghiem, L.T (2003). Income and income diversification of farm households in ChauThanh A district: A case of Tan phu thanh Village. *MSc. Thesis. Vietnam – Netherlands Master in Development Economics Program*, Hochiminh University of Economics.

Minot, N. (2003). Income Diversification and Poverty in the Northern Uplands of Vietnam. Prepared by Markets, Trade, and Institutions Division International Food Policy Research Institute Washington, DC.USA.

Provincial Statistical Office of An Giang, Can Tho, Soc Trang and Tien Giang in 2003, 2004.

Reardon, T, Berdegué, J., Barrett, C and Stamoulis, K (2006). *Household Income Diversification into Rural Nonfarm Activities*. Johns Hopkins University Press.

Reardon, Thomas, Christopher Delgado and Peter Matlon (1992). Determinants and Effects of Income Diversification Among Farm Households in Burkina Faso. *Journal of Development Studies*, Vol.28, pp 264-296.

Reardon, T (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development* 25 (5), pp. 735–748.

Warren, P., (2002). Livelihoods Diversification and Enterprise Development: An Initial Exploration of Concepts and Issues. Food and Agriculture Organization of The United Nations. Livelihood Support Programme (LSP).

# ANNEX 1.    SECTOR SHARES IN THE ECONOMY OF THE MEKONG DELTA (%)
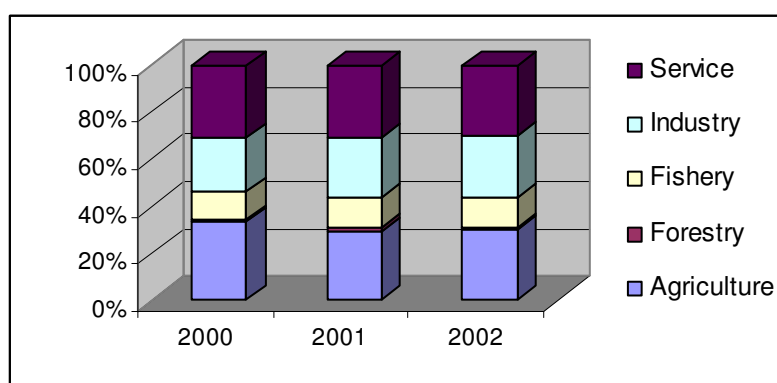


*Source: Vietnam's GSO. 2003*

Annex 2. Area and output of some main products in the Mekong Delta

| Items | 2000 | | 2001 | | 2002 | | 2003 | |
|---|---|---|---|---|---|---|---|---|
| | Thous. ha | Thous. tons | Thous. ha | Thous. tons | Thous. ha | Thous. Tons | Thous. ha | Thous. tons |
| - Paddy | 3.945.8 | 16.702.7 | 3.792.0 | 15.997.5 | 3.834.8 | 17.709.6 | 3.785.8 | 17.524.1 |
| - Maize | 19.0 | 51.8 | 22.9 | 95.5 | 26.5 | 112.0 | 31.6 | 138.6 |
| - Sweet potato | 9.9 | 124.1 | 10.1 | 144.8 | 12.5 | 209.9 | 10.7 | 189.8 |
| - Sugar-cane | 81.1 | 4.958.7 | 76.4 | 4.430.0 | 80.3 | 5.558.9 | 73.5 | 5.102.8 |
| Farmed aquaculture | 445.2 | 365.1 | 547.1 | 444.4 | 570.3 | 519.3 | 614.6 | 620.1 |

*Source: Vietnam's GSO. 2003*

Annex 3. Number of cattle and poultry in the Mekong delta      Unit: head

| Items | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|
| - Buffalo | 73.767 | 63.538 | 59.521 | 36.600 |
| - Cow | 183.906 | 197.210 | 203.929 | 278.200 |
| - Pig | 2.797.015 | 2.978.204 | 2.908.538 | 3.151.600 |
| - Poultry | 42.235.508 | 44.211.825 | 45.580.457 | n/a |

Source: Socio-economic data of 12 provinces in the Mekong delta. and Vietnam's GSO. 2002

# CDS Research Reports

R. Lensink, N. Hermes, *Regulatory Change and the Allocation of Finance: the Role of Business Conglomerates in the Case of Chili, 1983-1992*, No 1

A. Maatman, C. Schweigman, A. Ruys, *Synopsis of a Linear Programming Study of Farmers' Strategies on the Central Plateau in Burkina Faso*, No 2

N.Hermes, *New Explanations of the Economic Success of East Asia: Lessons for Developing and Eastern European Countries,* No 3

*State, Society and Ethnicity in Developing Countries: Lessons from the 1990s;* Lectures by Naomi Chazan, Martin Doornbos, Jan Pronk and Caspar Schweigman at the occassion of the festive opening of the Centre of Development Studies, February 1997, No 4

M. Thissen, P. Kerkhof, *The Dynamics of Reform Policy: a new political economy model with an application to Egypt*, No 5

R. Lensink, O. Morrissey, *Aid Instability as a Measure of Uncertainty and the Positive Impact of Aid on Growth,* No 6

N. Hermes, W.Salverda (eds.), *State, Society and Development: Lessons for Africa*, No 7

T. Thiombiano, *La Loi de Pareto: une loi sur l'inégalité ou sur la pauvreté? Réponses théorique et empirique*, No 8

E. Sterken, *Demand for Money and Shortages in Ethiopia*, No 9

C. Lutz (ed.), *Food Markets in Burkina Faso*, No 10

ZhongXiang Zhang, *Why has the Energy Intensity fallen in China's Industrial Sector in the 1990s ?*, No 11

P. Boele van Hensbroek (ed), *African Renaissance and Ubuntu Philosophy*, .No 12

R. Lensink and O. Morrissey, *The Volatility of FDI, not the Level, affects Growth in Developing Countries***,** No 13

F. K. Hien, *L'Entrepreneuriat Feminin au Burkina Faso : Une Etude Exploratoire*, No 14

C. Lutz, *Food Markets and Food Security in West Africa*, No 15

C. Schweigman, *Developmental Research in Africa : Some Lessons*, No 16

M. Kamminga, *On Global Justice*, No. 17

P. Weesie and J. van Andel, *On Biodiversity and its Valuation*, No 18

C. Schweigman, *Food Security: Opportunities and Responsibilities, Or: the Illusion of the Exclusive Actor*, No 19

C. Schweigman, *La Sécurité Alimentaire: Opportunité et Responsabilité. Ou: l'Illusion de l'Acteur Exclusif*, No 19a

A. Adegbidi, H. Dedehouanou, S. Kpenavoun, C. Lutz, *Dix Ans de Libéralisation du Marché de Mais au Bénin,* No 20

P. Boele van Hensbroek, H. Schoenmakers (eds), *From Social Exclusion to Lifelong Learning in Southern Africa*, No 21

M. van der Waal, Helen Wilcox (eds.), *Experience and Identity in Recent South African Literature*, No 22

Visser, H. Van der Heuvel-Disler (eds.), *Family Fictions*, No. 23

Fitsum Ghebregiorgis and L. Karsten, *Human Resource Management in Eritrea: Current and Future Trends*, No. 24

L. Karsten and B. Pennink, *Total Quality Management in the business community of Burkina Faso: a change in perspective on knowledge Development,* No.25

Ulla pape, Lara Sigwart, Jasmijn Melse, Bastiaan Aardema (eds.), *Investigating Comprehensive Security in the Humanitarian Context of Georgia NOHA Field Trip 10th-25th of May 2007, Final Report*, No. 26