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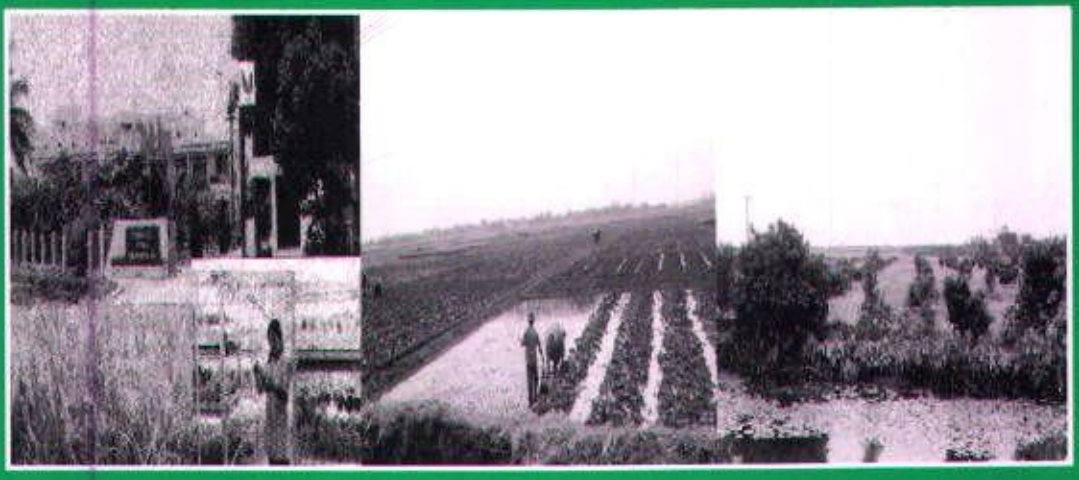
# Agricultural Innovation

## Multiple grounds for technology policies in the Red River Delta of Vietnam



Nguyen Van Linh

NN08201, 2956

## PROPOSITIONS

Belonging to the dissertation 'Agricultural Innovation, Multiple Grounds for Technology Policies in the Red River Delta of Vietnam' by Nguyen van Linh, 28 March 2001.

1. Most agricultural research in Vietnam understandably is technical in nature. Very little research has been carried out on innovation and policy formulation processes. This has seriously hampered the impact of public research and extension in the RRD. (*This dissertation*).
2. Official policies are based, whether explicitly or not, on ideas about 'what works' in terms of stimulating agricultural innovation. These ideas might be mistaken. (*This dissertation*).
3. In research of phenomena for which people play a key role in determining the outcome, a focus on reasons is more effective than a focus on causes. (*This dissertation*).
4. The fact that Vietnamese policy makers see new technology as the main source of growth for Vietnamese agriculture (and hence investment in technology as the most appropriate policy), while the innovation taking place in rural areas seems to be largely driven by farmers seeking opportunities to improve their incomes, suggests that science can be a 'blinding insight'. (*This dissertation*).
5. True potato seed (TPS) offers many obvious technical advantages, but is not accepted by farmers in general because of problems in the markets for both inputs and outputs. It seems from this and other examples, that the Red River Delta is moving from a post-war economy with a need for production and productivity to deal with shortage, to a market economy driven by gross margins and prices. (*This dissertation*).
6. Diversification calls for a broad research effort that includes studies of the economics of production of alternative crops in various locations and circumstances. Hence, in addition to research in technology, a strong policy and market analysis capability is essential for enhancing innovative performance. (*This dissertation*).
7. The development of more productive technologies is likely to make farmers poorer because advantages of technological change in agriculture are usually passed on to middlemen and consumers. This can lead to serious social problems if alternative employment outside agriculture is not available. (Cochrane, W.W., 1958. The Agricultural Treadmill. Chapter 5 in: Cochrane, W., *Farm Prices, Myth and Reality*. Minneapolis: Univ. of Minnesota Press, pp. 85-107).
8. Extension should be part of the research process rather than the final step in the adoption of research findings. Farmers should be willing and able to participate in this process, especially where complex agricultural and environmental issues are at stake (Dunn, T. *et al.* 1996. *Changing Paradigms for the Farmer-Extensionist Relationship: Exploring methods and Theories of Farmers' Participation in Research.* Journal of Agricultural Education and Extension Vol. 3 (3): pp. 167-182).
9. Arable farmers of 0.2 ha in the Red River Delta are just as unlikely to survive as arable farmers in the Rhine River Delta with 100 ha if they continue to focus on producing bulk commodities such as rice, wheat and potatoes. But high value crops are no guarantee for survival either.
10. In rice based systems, limiting IPM Farmer Field School Training only to the rice crop, and excluding winter crops, on which large quantities of pesticides are applied, does not bear testimony to great insight in agro-ecosystem dynamics.

# Agricultural Innovation

## Multiple grounds for technology policies in the Red River Delta of Vietnam

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# Agricultural Innovation

## Multiple grounds for technology policies in the Red River Delta of Vietnam

**Nguyen Van Linh**

**Proefschrift**

ter verkrijging van de graad van doctor
op gezag van de rector magnificus
van Wageningen Universiteit,
Prof. Dr. Ir. L. Speelman
in het openbaar te verdedigen
op woensdag 28 maart 2001
des namiddags te 16:00 uur in de Aula

1 baggs

**ABSTRACT**

Food security, a lingering concern although is not as critical as in the past, remains one of the most important strategies for agricultural development in Vietnam. In conjunction with this strategy, productivity is very much a concern of the government. However, growth in agricultural productivity is not easy to achieve, particularly for a severely land-constrained region such as the Red River Delta (RRD). The level of crop intensification is already high and given the competition for land from infrastructure development, urbanization, industrialization, and the production of fruit and other crops and aquaculture, there is little room for maneuver.

With the limited scope for land expansion, increasing yield and crop diversification are two challenges to the sustainability of the present rate of growth in the agriculture. With respect to rice yield, Vietnamese farmers have benefited by applying findings from international research to their local conditions, but over time, the benefits to be gained will be less and less. If the attempt were limited further to improving productivity of food crops, the difficulties would be compounded. Even under the most favorable conditions of growth, the living standards of those engaged in agriculture with a small size of land holding is not likely to be comparable to there of their counterparts in the urban areas, or to take them out of poverty. Thus, while rapid agricultural growth based on higher productivity will help raise farm incomes, the farmers will require alternative employment opportunities to break out of poverty and increase their living standards. Farmers need to be given sufficient degrees of freedom to be able to choose to improve their lives in ways that are different from what they have been doing, which is primarily growing rice. Therefore, one of important options is the diversification of the rural economy.

There are two possibilities for economic diversification in rural areas. The first is to diversify agricultural production. While this may be construed as conflicting directly with the objective of food security, this construction is based on equating food security with food self-sufficiency. The second possibility is to diversify the rural economy away from an overwhelming reliance on agricultural production. If adequate employment in the non-farm rural sector is generated, then issues such as rural-urban income inequality and rural poverty lose some of their significance, at least in those areas with reasonable infrastructure. But in recent years, the generation of rural non-farm employment has depended heavily on the performance of agriculture.

The RRD is a typical case with respect to diversification and sustainable development of agriculture in Vietnam. In this region, rice is still one of most important crops. It is planted twice in the year and followed by winter crops where possible. The farmers are facing the problem of a very low average amount of arable land available per household (0.3 ha). During the last years, in comparison with other regions, rice yields in the RRD have been recognized to be "reaching the ceiling" - according to farmers. However, the decline of rice price in the marketplace and increasing family demands for better living conditions has faced farmers with new challenges of low incomes.

With respect to technology development and extension, during the last decades, many efforts have been made by government institutions to assist farmers to resolve problems of low productivity in the region. The operation of intensification programs with a series of recommendations based on technical measures has contributed to the increase in food crop production. The development of true potato seed production in the winter season is one example. In order to improve farmers' knowledge of crop production, the Integrated Pest Management (IPM) program has been operated since early 1990s. However, those efforts, with their strong emphasis on rice production, do not always prove advantageous for farmers.

Contrarily, the increase of cash crop production and the development of new farming systems are of major interest of farmers in the region to resolve problems of low incomes. The expansion of winter crop production and changing land-use systems in rice fields are seen as two strategic decisions of farmers in the RRD to cope with scarce natural resources and low-income problems. Farmers in the region are very active in responding to market signals by adjusting their cropping patterns and enterprise mixes, unless constrained by policy and by physical, agronomic, financial and market factors. The successful case of farmers in Nam Thanh district in changing "flooding-land" with low potential for rice production into new farming systems with fruit trees and aquaculture shows farmers' capability in innovation.

This study looked at farmers' innovation processes in the densely populated RRD, and at official models of agricultural innovation, to develop theories to underpin technology (agricultural research and extension) policies of Vietnamese organizations. The work is based on the hypothesis that the innovation theory currently underpins agricultural technology policy in Vietnam does not adequately reflect the dynamic processes that take place in the field in the context of the (new) open market economic system. The findings may be useful for people who are working as policy-makers, research and extension managers in seeking new approaches to improve their work to meet farmers' needs.

## ACKNOWLEDGEMENTS

Many people have contributed to the completion of this thesis. First, I would like to thank Prof. Dr. Niels Röling for his critical comments and useful suggestions throughout my study. I greatly appreciate assistance and supports from Prof. Dr. A.W. Van den Ban and his colleagues in *The Stichting Redelijk Studeren (SRS) Foundation*, from the beginning of my study in the Netherlands in the MSc. program to the final stage of Ph.D. program at Wageningen University. Prof. Dr. Röling and Prof. Dr. Van den Ban also devoted time to visit and give me valuable comments during my fieldwork in Vietnam.

The completion of this thesis was impossible without assistance and support from staff members of the Group Communication and Innovation Studies (Wageningen University). I would like to thank all of them for their help and consideration.

I owe Dr. Elske van de Fliert, Integrated Pest Management Specialist/Sweet potato IPM Project Leader, International Potato Center, ESEAP Regional Office, for her time in reading and giving comments on one chapter of this book.

Current studies have been conducted within the Vietnam Agricultural Sciences Institute (VASI). I am very grateful to Prof. Dr. Nguyen Huu Nghia (Director of VASI), Dr. Bui Huy Hien and Mr. Le Quoc Doanh (Vice Directors of VASI) for their confidence and for providing me the opportunity to start this study. The (new) difficult topic of policy theories with respect to innovation conducted in a developing country such as Vietnam would have been impossible without their scientific support. During my work in Vietnam, I was given the chance to gain experiences from officials working as managers or policy-makers in different departments of the Ministry of Agriculture and Rural Development (MARD), research institutes, the Department of Agro-Forestry Extension (DAFE) and Provincial Extension Centers. I also had the opportunity to collaborate with the Food and Agriculture Organization of United Nations (FAO), Hanoi and some International Non-Government Organizations working in Vietnam in their studies in the field of rural development. These occasions and exposures have strengthened my confidence for writing this thesis.

At VASI, many people have contributed, directly or indirectly, to the success of the study. I wish to acknowledge:

- Prof. Dr. Dao The Tuan, head of Farming System Research Department, for his comment and suggestions on ideas for the study;

- Mr. Truong Van Ho, former director of Root Crops Research Center (RCRC), for his comments and suggestions on one of chapters of this thesis;
- Mr. Pham Hoang Ha, researcher, for his discussions of the changing land-use system in Gia Loc district, Hai Duong province;
- Mr. Bach Trung Hung, Du van Chau, Dang Dinh Quang, researchers, for their comments and for providing me with information about cropping patterns and farmers' assessment of official technical innovation projects;
- Mr. Nguyen Manh Trung, researcher, for his comment of current policy theory and for providing me access to discussion with different level policy-makers in MARD;
- Mr. Le Hoai Thanh, researcher, for his assistance in guiding me in making photographs in Nam Thanh district;
- In addition, I would like to thank all VASI staff who assisted me during my fieldwork.

One of the most important supports for this study was provided by local people to whom I would like to express my deep gratitude. They are farmers in communes of Thanh Xa and Tien Tien (Nam Thanh), Trong Quan (Dong Hung), My Tho (Binh Luc), Yen Phu (Y Yen), Ha Hoi (Thuong Tin), and Dong Tao (Chau Giang) where I have conducted the interviews.

And last but not least, I would like to thank my wife Truong Thi Ninh and my sons Nguyen Tuan Tai and Nguyen Tuan Trung who encouraged me to overcome difficulties during the fieldwork and made life more joyable and interesting.

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| a.i | active ingredient (pesticide) |
| AKIS | Agricultural Knowledge and Information System |
| CIP | International Potato Center (Peru) |
| DAFE | Department of Agro-Forestry Extension (Vietnam) |
| *Doi Moi* | Renovation (reform policy in Vietnam) |
| FAO | Food and Agriculture Organization of the United Nations |
| FCRI | Food Crop Research Institute (Vietnam) |
| FFS | Farmer Field School |
| FSR | Farming Systems Research |
| GDP | Gross Domestic Product |
| GOS | General Statistical Office (Vietnam) |
| GRET | Groupe de Recherches et d'Echanges Technologiques/Programme Fleuve Rouge |
| ha | hectare (10,000 square meters) |
| HAU | Hanoi Agricultural University |
| IAE | Institute of Agricultural Economy |
| IFPRI | International Food Policy Research Institute |
| IMF | International Monetary Fund |
| IPM | Integrated Pest Management |
| IRRI | International Rice Research Institute (the Philippines) |
| MARD | Ministry of Agriculture and Rural Development (Vietnam) |
| MRD | Mekong River Delta |
| MSTE | Ministry of Science, Technology and Environment (Vietnam) |
| NFSC | National Food Security Committee (Vietnam) |
| NGO | Non-government organization |
| NIPP | National Institute of Plant Protection (Vietnam) |
| NIN | National Institute of Nutrition (Vietnam) |
| PPD | Plant Protection Department (Vietnam) |
| RCRC | Root Crops Research Center (Vietnam) |
| RRD | Red River Delta (Vietnam) |
| *sao* | 360 sq.-m (in the North of Vietnam) |

| | |
|---|---|
| TOT | Transfer of Technology |
| TPS | (botanical) True Potato Seed |
| VAC | A Vietnamese farming model means Garden (V), Pond (A) and Cattle Shed (C) |
| VACVINA | National Association of Vietnamese Gardeners |
| VASI | Vietnam Agricultural Sciences Institute |
| VBARD | Vietnam Bank for Agriculture and Rural Development |
| VND | Vietnamese currency (1US$ = 14,400 VND, Nov. 2000) |

# Chapter 1
# COUNTRY BACKGROUND WITH EMPHASIS ON AGRICULTURE

This chapter presents general information about the country of Vietnam to allow the reader to have a general picture on agricultural regions, the economic situations and agriculture, policy and institutional reforms, as well as agricultural research and extension services in the last decade. The information also indicates issues of food security, agricultural diversification, and land tenure in Vietnam. The last section concerns government objectives for the development of agriculture and rural economy.

## I-General information

### I.1-The Country

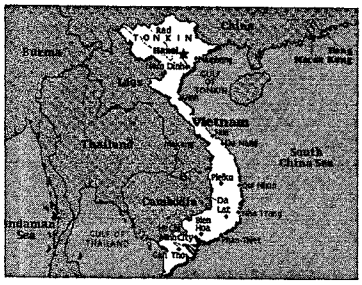


**Figure 1 - Map of Vietnam**

Vietnam is situated along the southeast margin of the Indo-Chinese peninsula. It stretches from latitudes 8.50 north to 23.8 north with the coastline of approximately 3,200 km and a land area of about 330 thousand km2. The country land borders are 1,150 km long with China, 1,650 km with Laos and 950 km with Cambodia.

Three-quarters of the country are mountains and hills. Lying between the mountainous highlands is the midlands (hills) region, which comprises about one-third of the country. The remaining areas (one-quarter) include the fertile plains formed by 15 major rivers. Amongst the major river are the Mekong, with a drainage basin of 72,300 km2 and the Red River of 60,960 km2 within Vietnam. The plain areas of the Mekong River Delta (MRD) in the south and the Red River Delta (RRD) in the north, with about 1,300 km between them, are the major agricultural areas and centers of population. Hanoi and the port city of Hai Phong are situated in the RRD and Ho Chi Minh City, the industrial and commercial center of the country, lies just north of the MRD.

The population of Vietnam is about 76 million and grows annually by 2.2 percent. The majority of the population is of the Viet (Kinh) ethnic group. Minority groups of some ten percent are concentrated mainly in the highland areas. Close to 76 percent of the total population lives in rural areas and about 74 percent of the total labor force is engaged in agriculture (IMF, 2000)[1]. Rural population densities average 194 persons/km2, but vary greatly by region. In the RRD, they range in different provinces from 893-1.092 persons/km2, about twice the level found in the MRD provinces. Nearly one-third of the population of the country lives in these two deltas. In the central highlands and the northern mountainous provinces, densities are under 100 persons/km2 (GSO, 1999)[2].

The administrative structure of the country consists of cities and provinces. The provinces are subdivided into districts, which are subdivided into communes, with each commune having many villages.

## I.2-Agricultural regions

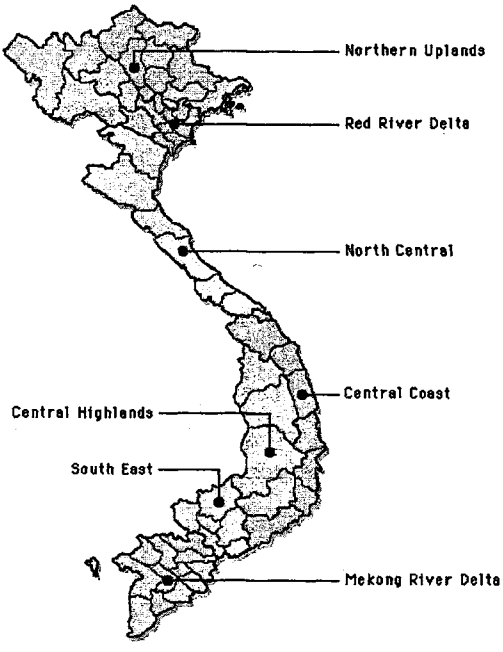


**Figure 2 - Agricultural regions in Vietnam**

Based on the variation in natural conditions (climatic, soil, water resources, and topography), the total of 61 provinces and cities in Vietnam has been divided into 7 agricultural regions (see Figure 2 and also Table 1).

### *I.2.1-Northern mountains and Midlands region (Northern Uplands)*

The region includes 14 provinces: Cao Bang, Bac Can, Lang Son, Ha Giang, Tuyen Quang, Lao Cai, Yen Bai, Thai Nguyen, Lai Chau, Son La, Quang Ninh, Bac Giang, Hoa Binh and Phu Tho.

[1] IMF Staff Country Report No. 00/116, August 2000. Vietnam: Statistical Appendix and Background Notes. Washington, D.C 20431.
[2] General Statistical Office, 1999

The region has three zones: northwest, northeast and midland with different climatic conditions. The midland zone is the transition between the northern mountains and the Red River Delta. This region produces around 12 percent of the total paddy production of the country. Rainfed paddy is dominant; hence the average yield is one of lowest among the seven regions (less than 3 ton/ha). Maize is one of the staple food crops in the region, which is also largest producer of the crop.

**Table 1 - Land utilization by agro-ecological zones in Vietnam**

(Estimated for the year 2000; Unit: '000 ha)

| | North Mountains | RRD | North central | South central | Central High land | North-east south | Mekong delta | Total |
|---|---|---|---|---|---|---|---|---|
| Total land area: | 10,296.1 | 1,251.2 | 5,117.5 | 4,518.6 | 5,611.9 | 2,346.9 | 3,956.9 | 33,099.1 |
| *I-Agri. land* | *1,665.2* | *749.2* | *887.8* | *668.5* | *906.1* | *1,123.4* | *2,803.3* | *8,826.3* |
| 1.1-Annual crops: | 964.2 | 645.2 | 608.8 | 477.7 | 341.6 | 578.9 | 2,242.0 | 5,880.5 |
| + Paddy | 597.6 | 589.1 | 422.7 | 265.8 | 156.7 | 294.0 | 2,025.4 | 4,351.3 |
| + 2-3 crops/year | 361.5 | 565.1 | 354.0 | 194.0 | 69.6 | 139.6 | 1,161.8 | 2,782.9 |
| + 1 crop/year | 235.8 | 24.0 | 68.7 | 71.8 | 87.1 | 154.4 | 863.6 | 1,568.4 |
| 1.2-Perrenial industrial crops | 328.5 | 38.5 | 156.2 | 123.0 | 497.7 | 495.9 | 355.0 | 1,995.6 |
| - Tea | 60.2 | 2.5 | 7.2 | 1.5 | 25.0 | - | - | 96.4 |
| - Coffee | 39.9 | 0.3 | 24.2 | 4.5 | 117.4 | 13.6 | - | 199.9 |
| - Rubber | - | - | 30.0 | 20.0 | 180.0 | 270.0 | - | 500.0 |
| - Cashew | - | - | - | 35.0 | 20.0 | 110.0 | 10.0 | 175.0 |
| - Mulberry | 3.5 | 10.5 | 4.0 | 14.0 | 60.0 | 4.0 | 4.0 | 100.0 |
| - Others | 224.9 | 25.2 | 90.8 | 48.0 | 95.3 | 98.3 | 341.0 | 924.3 |
| 1.3-Grass land | 301.0 | 4.3 | 80.3 | 52.5 | 58.3 | 36.6 | 1.1 | 534.1 |
| 1.4-Others | 71.5 | 61.2 | 42.5 | 15.3 | 8.5 | 12.0 | 204.4 | 416.1 |
| *II-Forest* | *7,129.3* | *105.8* | *3,463.0* | *3,428.7* | *4,297.8* | *783.1* | *504.2* | *19,743.1* |
| *III-Waste land* | *640.5* | *113.0* | *341.4* | *159.3* | *90.2* | *72.4* | *210.5* | *1,627.3* |
| *IV-Other uses* | *861.1* | *283.2* | *425.3* | *262.1* | *317.8* | *368.0* | *438.9* | *2,902.4* |

Source: FAO, TSS-1 Report: VIE/95/01T. *Agriculture in Post-Transition Vietnam: Opportunities and Challenges.*

### *I.2.2-Red River Delta region*

At present, the region includes 9 provinces: Ha Tay, Thai Binh, Ninh Binh, Hai Duong, Hung Yen, Ha Nam, Nam Dinh, Bac Ninh, and Vinh Phuc; and two cities of Hanoi and Hai Phong.

The climate changes little between provinces in the region. The hot season corresponds with the rainy season, which lasts from April to October. Irrigation development in the RRD has largely been completed since the 1960's, and covers 520,000 ha[3]. The region produces about 18 percent of total paddy production of the country, and is the major paddy-producing region after the Mekong River Delta (see next Chapter).

[3] General Statistical Office 1995

*I.2.3-Northern Central region*

The region includes 6 provinces: Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri and Thua Thien - Hue. This is the hottest region in the country.

*I.2.4-Central Coast region*

The region includes 8 provinces: Quang Nam, Da Nang, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan and Binh Thuan. Here, the region includes the narrow plains between Truong Son mountain range extending from the north to the south, and stretching in some places to the sea. The region suffers heavily from typhoons.

*I.2.5-Central Highlands region*

The region includes 4 provinces: Kon Tum, Gia Lai, Dac Lac and Lam Dong. The Truong Son mountain range runs from the north to the south of the region. The eastern side of this mountain range is very steep because it runs close to the coast. This region has excellent conditions for cultivation of perennial industrial crops, but paddy production is very limited, making it a major rice deficit region. Other food crops such as cassava are widely consumed.

*I.2.6-Southeastern region*

The region includes 5 provinces: Dong Nai, Binh Phuoc, Binh Duong, Tay Ninh, and Ba Ria - Vung Tau and the biggest city of the country (Ho Chi Minh City). The region is the transition between the Mekong River Delta and the Central Highlands. In addition to the alluvial plain along the Saigon and Dong Nai rivers, there are grey alluvial river terraces and red soils.

*I.2.7-Mekong River Delta*

The region includes 12 provinces: Long An, Tien Giang, Dong Thap, An Giang, Ben Tre, Vinh Long, Tra Vinh, Can Tho, Soc Trang, Kien Giang, Bac Lieu and Ca Mau. This is the most important paddy-producing region in Vietnam, providing nearly half of the total production.

## I.3-Economy and Agriculture (including forestry and fisheries)

With an average income of US$ 240, - (UNICEF, 1998), or US$ 370, - per capita (rank 167 of 206 countries as World Development Report 2000/2001: *Attacking Poverty*), Vietnam can be rated among the poorest countries in the world. According to UN reports, one of the underlying causes of poverty in Vietnam is the lack of access to resources, in particular land, credit and knowledge.

Data from General Statistical Office show that the agricultural sector contributed 33.8 percent to GDP and nearly 50 percent to export earnings in 1995-1997. In spite of the gradual decline in the share of agriculture in total GDP, it remains the dominant sector in terms of employment and contribution to export. Within agriculture, food crops such as rice, maize, sweet potato, cassava, potato and a few others are dominant, contributing nearly 45-47 percent of the gross value of agricultural output. The industrial crops such as coffee, tea, rubber and coconut contribute about 30 percent, while livestock contributes about 24 percent. Horticulture is increasingly becoming an important source of income for farmers and exporters. In 1994, a General Survey of rural areas and agriculture shows that there are 12 million households in the rural area. 9.64 million of them are engaged in the agricultural sector (80 percent of total rural population), while the remaining 2.4 million (20 percent) specialize in non-agricultural sectors, mainly in handicraft, small industries and trade (Cuc, 1995).

Vietnam today has an economy which is as liberal and dynamic as any other country within ASEAN (Association of Southeast Asia Nations), which it joined in 1995. During the last ten years, annual growth rates of GDP have surged to an average of 7-8 percent; in 1995, the economy grew by 9.5 percent (about 5.6% in 1999 as a result of the economic crisis in the region). In the agricultural sector, including forestry and fisheries, the growth rate has reached 4.2-4.3 percent annually[4]. This exceeded the population growth rate of 2.2 percent during the same period and led to a significant increase in per capita food availability and surplus for export. These successes, however, changed the basic structure of the economy and have brought along new challenges. The government, aware of the structural changes taking place in the economy, is searching for ways to face the emerging challenges to long-term sustained growth and development of the agricultural and rural sectors.

## I.4-Policy and institutional reforms

After the war, failure to stabilize macro-economic imbalances led to the tapering of the productivity gain, clearly indicating that success from attempts to improve policies in the period before 1986 was limited. The Sixth Party Congress held in December 1986 proposed "*Doi Moi*" (renovation), a comprehensive package of economic reform in the country. The key components of the reform package were:

* Reorganization of agriculture on a household basis rather than the collective;

[4] Record from Dept. of Planning and Projection, MARD, 1999.

* Granting greater autonomy in decision-making to state enterprises, including their right to contract for inputs and outputs;
* Abolition of almost all subsidies and price controls;
* Tax and expenditure reform to reduce the budget deficit;
* Increases in interest rates to positive real levels and restraints on credit expansion;
* Lifting of trade restrictions and the devaluation of the Vietnamese currency to bring the official rate in line with the market rate;
* Restructuring of the banking system to a two-tier system consisting of the central bank and state-run specialized commercial banks;
* Measures to encourage the development of the private sector; and
* A new Foreign Investment Law.

In early 1988, the Party and Government began to implement "*Doi Moi*". The "macro" and "micro" prices were brought in line with market levels to reflect true opportunity costs by substantially decontrolling the price of all commodities except electricity, oil and transport. All trading checkpoints were abolished. Private traders were allowed to participate in trading across the country and the farmers to sell freely to whom they liked. The State ceased control of prices and introduced a policy of intervention through the Pricing Commission in collaboration with the Ministry of Agriculture and Rural Development (MARD) to maintain a reasonable price at harvest. Export of agricultural products was also decentralized and provinces were allowed to trade externally.

An unintended casualty of the reforms has been the cooperatives, whose major functions in the collective farming system of the past were made "moribund" by the reforms. This decline in the role of the cooperatives is balanced by the growth in the power of local authorities.

The passage of the Land Law in 1993 and policy changes with respect to science and technology and transfer of technology to farmers complemented "*Doi Moi*". Improved rice varieties and animal breeds and the application of biological advances to agricultural production were widely introduced. Investments to improve and expand irrigation infrastructure and a network of agricultural extension services from central government (Ministry of Agriculture and Rural Development) to the provinces and to lower levels of districts and communes were established.

### I.5-Agricultural research network in Vietnam

At present, there are 35 agricultural research institutes in Vietnam, covering almost all important fields. The scientific and technical manpower is about 6,100 of which 451 have post-

graduate degree (Doctoral or Master of Science) and 2,643 have a graduate degree[5]. The Ministry of Science, Technology and Environment (MSTE) is the overall coordinator of all scientific research in the country, including agricultural research. The Ministry of Agriculture and Rural Development (MARD) has a Department of Agricultural Science and Technology with 35 key scientific officers in agriculture, forest and water resources, which coordinates the research activities of all the scientific research institutes in the country. In addition, there is the National Council of Agricultural Sciences (NCAS) with the task of overall monitoring, evaluation and guidance.

There are several constraints to the development of an appropriate research system in Vietnam. The most notable are lack of funds (only about 7 percent of the national budget is spent on science and technology in all branches, and only around 1 percent in agricultural research while agriculture contributed 25.4 % of total GDP in 1999)[6]; lack of coordination among research organizations; and lack of a critical minimum in priority areas.

In order to improve the functioning of agricultural research organizations, the Department of Agricultural Science and Technology (in MARD) has proposed to organize a national workshop, which would throw some light on the direction of research reform. Besides, the policy cell of the MARD is thinking in terms of restructuring the agricultural research system, and a National Center of Agricultural Research, in which most of research institutes will be merged, has been proposed.

### I.6-Technology transfer and extension services

Based on Decree No. 13/CP of March 1993, as well as Decree No. 73/CP on the establishment of the Ministry of Agriculture and Rural Development, the government introduced a new system for extension consisting of two forms: publicly management extension and voluntary extension.

The publicly management system is arranged into an integrated network from the center to grassroots, with the *Department of Agro-Forestry Extension* at central and the *Extension Center* at provincial and the *Extension Station* at district levels. Under the Provincial Extension Centers, there are district/inter-district Extension Stations and commune/inter-commune Extension Groups.

Nationwide, there are 61 extension centers in the provinces and cities, and approximately 1,500 extension workers are employed by the government. In addition, there are 377 district extension stations with nearly 1,500 personnel engaged as state employees[7].

[5] Record from MARD, 1999.
[6] MARD, 1999; IMF, 2000
[7] Record from Department of Agro-Forestry Extension, 1999.

Staffs of agricultural extension centers (i.e., provincial level) and stations (i.e., district level) are managed, instructed and paid by authorities at the respective level. Staffs employed in agricultural extension basic units, such as the commune, village and cooperative, are technicians and/or experienced farmers. They are assigned to carry out various experiments and propagate successful experiences. Their remuneration is paid through contracts signed with the agricultural extension stations at the district level.

The form of voluntary extension consists of the services provided by the different research and educational institutions, mass organizations, NGOs and individuals.

The research institutes and centers regularly undertake experiments or demonstrations in the research station or directly on farmers' fields. At the same time, they may organize "field conferences" as well as various short training courses in order to disseminate new technical progress for production. Some research institutes have also set up their own center for transfer of technology or center for extension. In general, the research and development institutions have succeeded in combining activities of research and technology transfer, and take an active part within the agricultural extension system of the country.

## II-Issue of food security and food self-sufficiency, specially with respect to the RRD

Vietnam is now a net food exporter. The food production target for the year 2000 is 30-32 million tons of paddy equivalents, with 27 million tons of paddies for domestic consumption and an additional 2-3 million tons for export. According to the General Statistical Office, in 1999 the country produced about 32 millions tons of paddy equivalents and exported about 4.4 millions of milled rice. However, half of the country's poor are still classified as food poor (in the sense that they cannot meet their basic calorie needs even if they were to devote all of their consumption to the basic food basket), and there is still a high demand for food and nutrition in the country[8].

Generally, the definition of food security in Vietnam arises mostly from households not having sufficient income to buy the food and to a limited extent due to lack of access. The isolation of rural villages from market centers owing to the poor state of infrastructure, however, makes food consumption of rural households vulnerable to production risks. In the present context of the country, the way to ensure food security is to find the means whereby households can earn sufficient income. The solution to the food insecurity problem is therefore subsumed under the poverty alleviation program and related to rural employment opportunities.

The price of food is one of important factors affecting real incomes of farmers. Keeping market prices artificially low as a way of helping poor food-deficit households, e.g., by imposing

[8] Seminar on Household Food and Nutrition security, Hanoi, Sept. 1999

barriers on rice exports, is not seen as a good policy of the government. The poor include a considerable number of paddy producing households. A lower price of food implies a lower income for these producers who are the poorest amongst the farming population, especially those with a small acreage of arable land in the RRD. Lower food prices may discourage production, although in some cases it may stimulate economic diversification.

The issue of food security is closely associated with food self-sufficiency, especially for farmers in the RRD. The present level of rice production is associated with several policy measures such as restrictions on conversion of paddy land to other uses, as well as with subsidies on irrigation. The question is whether removal of the decree limiting conversion of rice land to other forms of production will lead to a decline in paddy production. It will, of course, depend on the relative profitability of paddy vis-a-vis alternative crops.

In the RRD, rice production is not very profitable relative to other crops. In 1992, price of rice fell below production cost and since 1994 the government has intervened in the market by purchasing huge amounts of rice to shore up prices. A study conducted by the International Food Policy Research Institute (IFPRI, 1995) showed that there was a substantial decline in the price competitiveness index for rice by an average annual rate of 5.5 percent during 1989-95. In the new economic environment, income from rice production remains much lower than the income from other production activities. The policy to restrict conversion of paddy land could create a lot of resentment, and perpetuate poverty amongst the paddy farmers.

### III-Agricultural Diversification

In the course of time, market demand for various agricultural products increases when incomes raise and population grows. The diet becomes more varied. In the country, rising income along with industrial development and the consequent change in economic structure is fuelling the demand for livestock products and high-value crops. A survey conducted by the GSO (General Statistical Office) in 1995 showed that monthly (milled) rice consumption has decreased from 13 kg in 1990 to 11 kg per capita in1995, and annual meat consumption per capita has increased to 15.2 kg in 1990 compared to 8.4 kg in 1980. Animal husbandry, high-value horticulture and industrial crops have potential for very rapid growth and are less subject to land constraint than food crops, including rice. However, the growth of animal husbandry is likely to make maize an increasingly important cereal crop that is again subject to land constraint.

Crop diversification is essential for the economic viability of agriculture in the long run. This offers the best opportunity to maximize returns from agricultural land and to increase farm income. Crop diversification during the past years has been implemented under various forms and scales, especially in the Southeast Region and the Central Highlands. As a result, these two regions

have recorded the highest agricultural growth rate nation-wide with the most rapid adjustment in rural economic structure and the most rapid increase in farmers' incomes.

In the Red River Delta, crop diversification has emerged as having much more economic potential (see Chapter 5 & 6). In this area, there is considerable evidence that farmers have historically responded to market signals by adjusting their cropping patterns and enterprise mixes, unless constrained by policy and physical, agronomic, financial and marketing factors. Examination of agricultural development in the past showed that it could be usefully characterized as a process of capturing "techno-economic niches".

Though the emergence of techno-economic niches can not be predicted with certainty, technological evolution, changes in farmers' access to technologies and externally determined changes in input/output relations all combine to create such niches. Thus, diversification calls for a broad research effort, which includes studies of the economics of production of alternative crops (including trees) in various locations and circumstances. In setting diversification priorities, cognizance must be taken of the state-of-the-art of growing alternative crops and the need to close the knowledge gap. In this sense, the government and research and extension organizations must play an active role. The essential task of the crop diversification program is to identify where opportunities for greater return exist, to introduce appropriate policies to make diversification economically attractive and to assist farmers to capture the opportunities. Thus, in addition to research programs, a strong policy and market analysis capability is essential, especially for each specific region.

Although sometimes policy-guided interventions play an important role in inducing the changes that created the niches, the principal force spurring their occupation is the perception of advantage by the farmers themselves. They remain the ultimate decision-takers, and those who have managed to diversify, have increased their incomes and contributed to overall agricultural growth. The local suitability of emerging technologies is profoundly influenced by variations in the physical environment, such as soil characteristics, climate, hydrology, and access to markets, etc., matters in which nobody is better informed than the farmers themselves. However, in areas of the country, diversification involves new ventures that involve new risks.

### IV-Land-use rights

Probably the most radical of the reforms implemented during the *Doi Moi* policy has been the granting of long-term leases to Vietnamese farmers (twenty years for land under annual crops and up to fifty years for forest lands). Furthermore, this "right to cultivate" is explicitly transferable and implicitly inheritable. The Vietnam Bank for Agriculture and Rural Development (VBARD)

accepts the right-to-cultivate certificate as collateral. For most purposes, this arrangement is similar to what is called "leasehold" in the West, although the duration of the lease is shorter than for most Western leasehold properties.

However, the arrangement is hedged with certain restrictions on land use. Firstly, there is a ceiling on landholding by families. A farmer can not cultivate more than three hectares of paddy land, although informal discussions indicate that this ceiling is often exceeded, sometimes openly. Secondly, land use is restricted. In particular, lands designated for paddy must be used to grow at least one paddy crop a year. Similarly, land designated for trees or forest must be planted to trees. In particular, insistence that paddy land should not be diverted from rice is based on a "food security" argument. "Food security" in this context is the same as food self-sufficiency, which seems an inadequate basis for policy, as has already been argued. Finally, the fixed-term lease contract may be storing up problems for the government when the lease runs out. Although in the vast majority of the cases, automatic renewal of the contracts to the old tenants can be assumed, problems can arise in cases where the leaseholders have deviated from the terms of the contract, for example, by planting other crops other than those designated in the lease contract.

## V-Legislation related to agricultural development

Vietnam's economic policy was substantially reoriented in 1989. Key farm policy objectives remain to ensure food security, provide new income and employment opportunities, eliminate poverty and generate foreign and domestic savings to finance the modernization of the economy. The Sixth Party Congress introduced a series of fundamental reforms ending price controls and re-establishing the farm household as the basic unit of production (Decree No. 10, 1988). The economic liberalization ("*Doi Moi*") proceeded Vietnam's impressive move from a net importer of rice to one of the World's top two exporters in 1997. However, the production response was limited: mostly to rice and mostly to the MRD highlighting the need to broaden the range of exports derived from agriculture. High priority has been accorded to farm income stabilization particularly with regard to reducing weather-created and market risks. Policy attention is being given to the need to diversity agricultural export income while improving rural incomes. The key focus of the Government strategy to achieve this is the transformation of institutions supplying services to small holders.

Some of the most important ideas are:

-***Multi-sectorial economy policy***: The structure of agricultural production has shifted from the bi-sectorial (mainly State economic enterprises and collective economic enterprises) to multi-sectorial production. The policy has involved different economic sectors (such as private, cooperative and state) in strengthening agricultural production. Each sector has the same right and is equal before the law.

***-Land policy***: The law allowing individual farming on previously communal lands was promulgated in December 1987. The State allots land to farmer households for a long-term use (15 years for annual crops and 30 years or longer for perennial crops). Land users can wholly decide the cropping system, cropping method, and cropping multiplication, and so forth on their allotted land. New land tax rates have been collected from January 1994. The extra crops and agro-products are not subjected to taxation. Land users can also sell or transfer the results of their investment in cash or kind on the allotted land. Farmers welcome the State's new policy on land allotment, although they still worry about the duration of land allotment, and hence are hesitant to invest in land improvement.

***-Policy on input supply and price***: Important inputs for agricultural production such as fertilizers and insecticides are supplied mainly by importation from abroad. The State tries to import the necessary inputs, which are distributed without subsidy. There is no fertilizer law, but standards have been established for urea, super-phosphate and thermos-phosphate. The Ministry of Agriculture and Rural Development (MARD) has issued some regulations on seed applied for paddy and soybean crops, and on pesticide use.

***-Policy on the investment and construction of infrastructure***: Many efforts have been and are being made by the State to invest in and construct projects of key importance, such as water conservation, electricity supply, transport and communication, land reclamation, and so forth. The national water charge policy was amended in November 1987 by the Council of Ministers (Decision 217). This has helped farmers in the development of their production. This policy is implemented on the principle of "The State and people join together". However, due to lack of finance, and the high demand, this policy has not yet satisfied the need, although the State has tried its best.

## VI-Government objectives for the development of agriculture and rural economy

### VI.1-General objectives and strategy for improving technology

During the period 1996-2000, government efforts to develop agriculture and the rural sector focus on:

1) Comprehensive development of agriculture; promoting the continued growth in crop productivity to ensure universal food security; and to quickly increase meat, fruit and vegetable production to improve the quality of food intake to reduce malnutrition;
2) Expansion of area under industrial crops, development of the marine and the forest resources in an ecologically sound and sustainable fashion;
3) Transformation of the structure of the agricultural and rural economy, expansion of agro-processing and agro-forestry, providing job opportunities in the rural areas and conservation of the environment to improve and gradually increase the quality of rural life.

The strategy for reaching these objectives includes measures to increase agricultural land and improve incentives to invest in land; encourage product diversification and quality improvement; improve rural infrastructure and water management, and promote market development. Measures will also be initiated to strengthen the application of scientific methods to the sector, and improve the technical knowledge of farmers. The strategy for improving technology includes:

* Strengthen the nationwide agricultural extension service to ensure the dissemination of modern agricultural techniques;
* Collect, compile and disseminate technical and market information and re-enforce existing cooperatives, producer groups and other community based organizations for extending information to farmers and rural communities. Farmers, scientists, economists, and enterprises will be encouraged to work together in identifying new production techniques and applicable models, in preparing demonstration models, and in developing applied training programs;
* Improve international networking with applied research institutes and encourage foreign investment in the agricultural sector so as to facilitate the transfer of technology. Improve research facilities, particularly applied research aimed at adapting international technologies to local needs;
* Rationalize the number of research institutes, improve coordination of research, and increase training staff.

### VI.2-Key components of strategy and challenges to address rural poverty

In paddy, the national average yield of rice was 4.1 tons/ha in 1999 (in 1995 it was about 3.7 tons/ha)[9]. This yield is low compared to the one obtained in China, Indonesia and South Korea, but it is higher than that in countries such as Thailand (2.3 tons/ha), the Philippines (2.6 tons/ha), India (2.8 tons/ha) and Malaysia (3.1 tons/ha). There is, therefore, a potential for further increasing production of most of the crops, including rice by further increasing yields. Recorded high yields of (paddy) rice crop of over 10 tons/ha/year (5 tons/ha/season) have been obtained in several provinces in Vietnam.

Productivity is very much a concern of the government in the development of agriculture. However, growth in agricultural productivity is not easy to achieve, particularly for a severely land-constrained economy such as Vietnam. The level of crop intensification is already high and given

[9] IMF, 2000, cited.

the competition for land from infrastructure development, urbanization, industrialization, and the production of fruit and other crops and aquaculture, there is a little room for maneuver. With the limited scope for land expansion, increasing yield and crop diversification are two challenges for the sustainability of the present rate of growth in agriculture. With respect to rice yield, Vietnam has benefited by applying findings from international research to Vietnamese conditions, but over time, the benefits to be gained will be less and less.

If the attempts were limited to improving productivity of food crops, the difficulties would be compounded. Even under the most favorable conditions of growth, the living standards of those engaged in agriculture with a small size of land holding are not likely to be comparable with those of their counterparts in the urban areas, or to take them out of poverty. Thus, while rapid agricultural growth based on higher productivity will help raise farm incomes, the farmers will require alternative employment opportunities to break out of poverty and increase their living standards. Farmers need to be given sufficient degrees of freedom to be able to choose to improve their lives in ways that are different from what they have been doing, which is primarily growing rice. Therefore, one of the important options is the diversification of the rural economy.

There are two possibilities of economic diversification in rural areas. The first is to diversify agricultural production. While this may be construed as conflicting directly with the objective of food security, this construction is based on equating food security with food self-sufficiency. The second possibility is to diversify the rural economy away from an overwhelming reliance on agricultural production. If adequate employment in the non-farm rural sector is generated, then the issues such as rural-urban income inequality and rural poverty[10] lose some of their significance, at least in those areas with reasonable infrastructure. But in recent years, generation of rural non-farm employment has depended heavily on the performance of agriculture.

[10] In six out of the seven regions of Vietnam, urban expenditures have grown at significantly faster rates than rural expenditures. The widest gap between urban and rural expenditure growth is in the North Central Coast, where the rate of urban expenditure growth (86 percent) is a staggering 49 percentage points higher than the rate of rural expenditure growth (37 percent). The Red River Delta is the exception—this is the only region in Vietnam where the rate of growth of rural expenditures (51 percent) has surpassed the rate of growth of urban expenditures (47 percent). Source: World Bank estimates based on VLSS93 and VLSS98. In: Vietnam Development Report: *Attacking Poverty*. Joint report of the Government - Donor - NGO working group. Consultative Group Meeting for Vietnam, Hanoi, Dec. 14-15, 1999.

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**Chapter 2**
**INTRODUCTION**

This chapter provides some more detailed information about the Red River Delta as the region was chosen as the area of study. From this information, the chapter draws social and research problems with hypotheses for the study. Justifications and research objectives are also presented. At the end, the chapter shows briefly the methodology that is used in the study.

## I-The Red River Delta

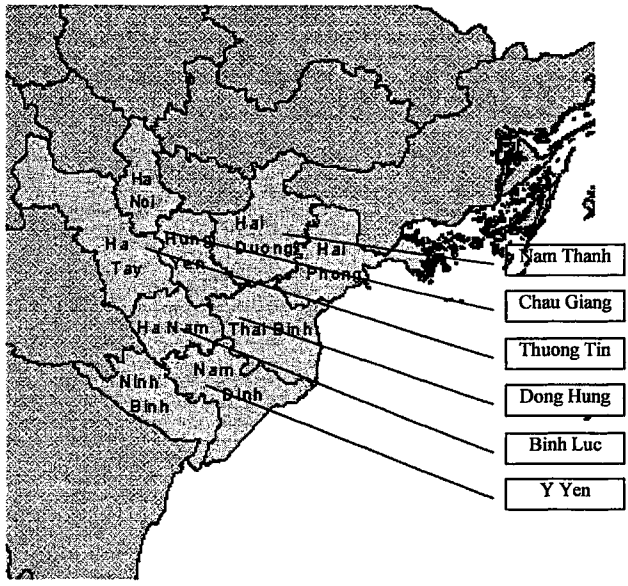


**Figure 3 - Map of the Red River Delta and study sites**

The Red River flows through southern China, where it is called the Yuan Jiang, to northern Vietnam, where it is known as the *Song Hong*. The river rises in the mountains of Yunnan Province in China, and flows southeast for more than 1,127 km (more than 700 miles), emptying into the Gulf of

Tonkin through several mouths. The chief tributaries are the Black (Song Da) and Clear rivers. The delta of the *Song Hong* forms one of the most fertile and populous areas in Vietnam.

As mentioned in Chapter 1, Vietnam's two main agricultural regions are the Mekong River Delta with twelve provinces and the Red River Delta with nine provinces[11]. The Mekong River Delta lies between latitude's 9° and 10° N, and the Red River Delta about 21° North of the equator. Vietnam agriculture is based on rice production for domestic consumption and export. This rice production is concentrated in the MRD in the South and the RRD in the North.

Agriculture is the most important sector in the RRD, accounting for 67 per cent of employment and 26 per cent of GDP in 1999[12]. A significant increase of spring and summer paddy crop production has been achieved since 1990. In 1997, average rice yield in the region was estimated as 11 tons per hectare (two rice crops). In the last several years, about 15 percent agricultural production of the RRD was used for supporting other regions in the country, and 10 percent for export[13].

Agriculture is the main sector of the Vietnamese economy. In the Red River Delta, agriculture is the major food source for Hanoi, Hai Phong and the Quang Ninh coal area, as well as for the mountainous and midland areas. In recent years, agriculture in the RRD contributes considerably to the stabilization of life and production in the whole country. In many years, agriculture has taken the lead in providing employment to the rural population as well as to the inhabitants of small towns and cities.

Agricultural production in the RRD is mainly characterized by rice and other food crop production. Food crops constitute 52 percent of gross agricultural production in the region, vegetables 16 percent, cash crops 10 percent, and animal husbandry 22 percent. In comparison with other countries, each hectare of land in the RRD produces only 1,560 $US, which is half the value of one hectare of land in Japan where agriculture is heavily subsidized, or one third in Taiwan (VIE/89/034, 1995)[14].

The total area of agricultural land in RRD is about 749,200 ha in which 86 percent is used for annual crops. Of the 645,200 ha of annual cropland, 91 percent is used for paddy and 565,100 ha (or 87 percent) of this paddy land is at least double cropped (two paddy crops, or one paddy crop with one or two subsidiary crops). About 61,200 ha, mostly outside the dykes and thus prone to monsoon flooding, is used permanently for subsidiary crops such as soybean, maize, and vegetables (see Table

[11] Before 1996, the number of provinces was recorded as nine provinces in MRD and eleven provinces in the RRD.
[12] World Development Report, 2000/2001.
[13] *Data of the Red River Delta.* Center for Regional Research and Development Aids of Red River Delta (CRRDA), p. 195. Sciences and Technical Publishing House, Hanoi 1997.
[14] VIE/89/034 - Project document, 1995. *Agricultural production in the Red River Delta - Situation Analysis.* Ministry of Agriculture and Rural Development.

1). The RRD is the second major granary of the nation and had a production about 4.6 million tons of paddy in 1995.

In the delta, farms are small (0.3-0.4 ha) and fragmented (6-10 plots up to 2 km apart). The RRD had a population of 16.8 million in 1992, of the labor force (excluding children and old people) 74 per cent works on agricultural production with almost 3.0 million farm families. The population growth rates in the 5-year period 1988-1992 averaged 2.28 per cent and 2.50 per cent respectively for the total and the agricultural population. The agricultural work force (5.65 million people in 1992) grew faster, at a rate of 3.14 percent per annum over the same period (GSO, 1992).

Until 1993, all plots within cooperative boundaries were allocated to family units on an equity basis which depended on the:

* number of working persons (16 to 50 years of age) in the family residing in the village;
* total area of available land;
* suitability of land (irrigation, upland, aquaculture, agro-forestry); and
* distance to the family home.

In addition to agricultural land, all families have a house-lot of about 100-200m$^2$ on which vegetables and fruit trees are grown and animals are raised. Under the 1993 new land law, land-use rights are not allocated to working persons residing in the village, but to all individuals in the family (on a per capita basis), including of returnees from military or civil services. Due to the possibility of transferring land-use rights to neighbors or others, average farm size increases, plot scattering is reduced to only two or three plots compared with the 7 to 10 plots per farm in the past.

**Table 2 - Farm size, number of plots per farm and number of farm families (1992)**

| PROVINCE | FARM SIZE (ha) | NUMBER OF PLOTS PER FARM | NUMBER OF FARM FAMILIES |
|---|---|---|---|
| Hanoi | 0.262 | 7.8 | 168,620 |
| Ha Tay | 0.306 | 9.2 | 399,995 |
| Hai Hung* | 0.276 | 7.0 | 577,450 |
| Hai Phong | 0.301 | 9.0 | 225,000 |
| Nam Ha* | 0.296 | 8.7 | 534,630 |
| Ninh Binh | 0.460 | 9.2 | 138,783 |
| Thai Binh | 0.381 | 7.7 | 394,985 |
| Ha Bac (11 districts)* | 0.332 | 8.5 | 311,405 |
| Quang Ninh (4 districts) | 0.425 | 9.5 | 45,526 |
| Vinh Phu (6 districts)* | 0.353 | 7.2 | 176,580 |
| **Red River Delta (in average/total)** | **0.304** | **8.8** | **2,972,974** |

*Source: Provincial Socio-economic Statistical Information (1988-1992)*

Note: * in 1996, these provinces have been divided into smaller provinces.

Paddy is by far the most important crop, yielding on average (for both the spring and summer crop seasons) of 3.36 ton/ha over 1.23 million ha during 1988-1992. The next most important crops are maize, yielding a moderate 2.1 ton/ha over 100,800 ha; sweet-potato producing a relatively low 7.59 ton/ha over 97,000 ha as a winter crop; and potato with the average yield of 9.95 ton/ha over the total

area of 30,339 ha (GSO, 1988-1992). The paddy area is stable, but yield and production increased in recent years. The area of other annual and perennial crops is relatively small.

## I.1-Rice production

**Picture 1: Rice production in Vietnam**

Rice is one of the most important crops in the Vietnamese economy as well as a dietary staple. Agriculture in the region is still done primarily by hand or with simple machinery.

There has been a rapid and significant change in the choice of rice varieties towards those, which can produce a high yield in a short growing period, in combination with resistance to pests and diseases. Yields of 6 ton/ha to 7 ton/ha (or more in some areas) per year are readily achieved by many farmers in areas with good irrigation and drainage facilities, and where farmers apply high rates of fertilizers in a timely manner. The use of early maturing rice varieties has allowed a significant increase in cropping intensity. In general, the risk of pest and disease damage is expected to become less significant due to improved varietal resistance and the gradual introduction of the Integrated Pest Management program. Major risks for monsoon crops caused by flooding have declined after the construction of Hoa Binh dam. With further improvement to drainage systems, food losses will further decline.

Rice production constraints are generally due to farmers not using the most appropriate varieties for their soil and water management situations, and farmers not using adequate fertilizers, because of either ignorance, or lack of cash or access to credit (Binnie, 1994). Crop production technologies are generally highly adapted to local soils and irrigation and drainage conditions. Labor-use for crop production reflects high labor availability, rather than actual labor needs. There is considerable underemployment and unemployment in farming areas, with the possible exception of the busy harvest and planting periods, the latter with a very short turnover period between crops.

Improvements in the maintenance and operation of irrigation and drainage systems need to be made. Only small areas of land could be serviced with new irrigation systems, while large low-lying areas have drainage constraints. A priority is to determine whether one irrigated spring rice crop (or other kinds of crop), together with fish farming during the remainder of the year, has financial advantages compared with high cost drainage improvement. Non-irrigated areas, and uplands that are not flood prone, are considered for fruit tree orchards and for crops such as tea, mulberry, etc. These crops are creating considerable employment opportunities. However, technical and financial viability

and appropriate marketing arrangements should first be established before new crops are widely accepted by farmers.

## I.2-Research and Extension Services

In the last several years, one of the major factors that contributed to the impressive growth rate of the agricultural sector was the development and transfer of technologies. Since the possibilities for reclaiming new land are limited, the priority has been given to intensification of farming based upon the development of agricultural research and extension. Due to the application of new scientific and technological measures, average paddy yield per hectare in 1995 had gone up by 79 per cent compared with the level in 1986 (Cuc, 1995). It is estimated that about 55 percent of the increase in production as due to the increase in crop productivity.

There are 13 major institutions conducting ***agricultural research*** in the RRD (see Table 3). Most are located in or near Hanoi. They serve the entire country, but because of the proximity to the RRD, much research is focused on crops, cropping systems, soils, pests, diseases, post-harvest technologies, and crop processing operations in the RRD. Developing new and high yielding crop varieties is a priority in research policy. In fact, most of the high yielding varieties of rice are derived from advanced lines introduced from IRRI[15] in the Philippines and from China. Most improved varieties of other crops are also from international institutions, and have been adapted to the local environment and management practices.

There are adequate agricultural research facilities, but research output is far below what could be expected from a large pool of university trained staff (Binnie *et al.*, 1994). On-farm verification research is almost non-existent. This has resulted in a lack of locality-specific production technology for low fertility soils and where water management is inadequate. Farming systems research has not received adequate attention from policy-makers. This task has been left to the Viet-France research program in the RRD. No research on agricultural extension (methods or methodologies for extension work) has been carried out.

With respect to crop production, cropping systems research and on-farm verification trials are insufficient in the RRD. There is the need for research, both basic and adaptive, especially with regard to the optimization of cropping systems on various soil types, and irrigation and drainage regimes. This is needed to ensure that maximum use is made of available short duration high yielding crop varieties and of the cool winter climate for high value crops. Since the early 1990s, the Vietnamese Government has participated in FAO's inter-country program on Integrated Pest Management (IPM) in rice in South

[15] IRRI - International Rice Research Institute

and Southeast Asia. Farmer Field Schools, in which farmers re-discover the agro-ecosystem of their fields, were introduced in Vietnam on a national scale in 1992 (Tuyen, 1997).

**Table 3 - Major research institutions in the RRD**[16]

| Name of institution | Total staff members (1998) | Major function and duties |
|---|---|---|
| 1-Vietnam Agricultural Sciences Institute (VASI) | 490 | -Conducts basic and applied research in agricultural sciences;<br>-Post graduate training;<br>-Technology transfer (extension). |
| 2- National Institute for Agricultural Planning and Projection (NIAPP) | 573 | -Surveys of agri. resources, projection and planning of agr. production;<br>-Generation and storage of basic data for projection and planning;<br>-Studies on methods for evaluating natural resources. |
| 3- Food Crops Research Institute (FCRI) | 260 | -Research on food crops and some special fruit trees;<br>-Research on intensive production technologies for food crops;<br>-Producing foundation seed of food crops and transfer of advanced technology in food crop into production. |
| 4-Maize Research Institute (MRI) | 55 | -Maize breeding;<br>-Maize production practices;<br>-Transfer of new technology. |
| 5- Institute of Agricultural Genetics (IAG) | 116 | -Research and application of modern genetic methods and bio-technologies for selection and creation of new crop varieties;<br>-Improvement of micro-organisms for food and foodstuff conservation;<br>-Promotion of international cooperation. |
| 6- National Institute for Soils & Fertilizers (NISF) | 200 | -Research, validation and application of new technologies on soils and fertilizers;<br>Production, testing and verifying quality of fertilizers;<br>-Training and advisory work. |
| 7- National Institute of Plant Protection (NIPP) | 150 | -Creates and coordinate national research and development on plant protection throughout Vietnam;<br>-Studies all pest problems on crops/plants;<br>-Development and use of microbial agents, natural enemies and botanical pesticide;<br>-Method of adequate use of chemicals followed by IPM. |
| 8-National institute of Animal Husbandry (NIAH) | 3,049 | -Studies on animal breeding and feeds;<br>-Studies on veterinary sciences;<br>-Livestock management<br>-Technology transfer. |
| 9- Post-Harvest Technology Institute (PHTI) | 104 | -Studies on new technologies in post-harvest processing, including post-harvest equipment;<br>-Technology transfer. |
| 10- Agricultural Economics Institute (AEI) | 60 | -Studies on agricultural economics. |
| 11- Sericulture Research Center (SRC) | 100 | -Studies on silk worm and mulberry;<br>-Studies on insects and diseases of mulberry and silk worm;<br>-Technology transfer. |
| 12- Research Institute for Fruits & Vegetables (RIFV) | 115 | -Studies on variety improvement of fruit trees and vegetables;<br>-Studies on post-harvest processing;<br>-Cultivation practices;<br>-Technology transfer. |
| 13- Vietnam Institute for Agricultural Engineering (VIAE) | 180 | -Studies and design of instruments and machinery for agriculture;<br>-Testing and demonstration of new technologies. |
| total | 2,825 | |

On March 2, 1993, the Government issued Decree No. 13-CP on the regulation of Agricultural Extension work. Formally, the network of agricultural extension (including forestry and aquaculture extension) has been established since 1993.

[16] *Scientific and Technological Research Development Institutions*, Special No. 98. Hanoi, 10-1998.

***The Agricultural Extension Department*** under the Ministry of Agriculture and Rural Development (MARD) administers extension services for the whole country from its headquarters in Hanoi capital, with a substantial delegation to permanent offices in the southern (Ho Chi Minh city) and central (Nha Trang) regions. There are seven divisions: Administration and Personnel, Planning and Foreign Co-operation, Information and Training, Food and Foodstuff Crops, Industrial and Fruit Tree Crops, Small Animals, and Large Animals. Each of these divisions is represented in all provincial agricultural offices, from where field extension in the districts is supervised by ten to thirty staff.

In 1993, the MARD moved the extension service away from being an adjunct to the centrally planned production system towards a provincially based service for small holders. Plant protection and research services are also being adjusted. A separate Plant Protection Department with different field staff has begun implementing an Integrated Pest Management program.

At provincial level, the *Agricultural Extension Center* has been established to implement governmental extension programs and to administer extension stations at district level. There is an *Agricultural Extension Station* in each of the districts that maintains contact with the cooperatives and communes, of which some of the larger ones have their own extension workers. Generally, these cooperatives or communes provide their members with crop production information and advice on the availability and costs of inputs, arrange for seed production, etc. Each district usually has its own material inputs supply company (governmental sector), from which individual farmers and cooperatives purchase inputs and small tools. These supply companies, both at district and provincial levels now experience considerable competition from private shops. The supply companies and also some of the larger fertilizer, seed and agro-chemical (state) distributors frequently offer crop production advice.

**Table 4 - Public agricultural extension in Vietnam**

| | Region | No. of Centers for Agricultural Extension | Average staff in each Center | No. of Stations for Agricultural Extension | Average staff in each Station | Total staff members |
|---|---|---|---|---|---|---|
| 1. | Northern Mountainous | 16 | 18.3 | 121 | 4.3 | 814 |
| **2.** | **Red River Delta** | **9** | **22.5** | **50** | **1.4** | **272** |
| 3. | North-central | 6 | 21.0 | 61 | 4.6 | 406 |
| 4. | Coastal Central | 8 | 17.8 | 29 | 2.5 | 214 |
| 5. | Central Highland | 4 | 15.2 | 37 | 2.8 | 164 |
| 6. | South-east | 6 | 20.5 | 24 | 4.3 | 226 |
| 7. | Mekong River Delta | 12 | 28.6 | 55 | 6.2 | 684 |
| | Total | 61 | 23.1 | 377 | 4.0 | 2,780 |

Source: *Agricultural Extension of Vietnam* July 1998, Ministry of Agriculture and Rural Development.

Most research institutes and centers, as well as special crop production unions and companies have their own extension branches, usually for their particular activities or crops. They do transfer of

technologies to farmers and are a bit different from public agricultural extension that implements extension program supported by government.

At the provincial and lower levels of the extension network, most staff members are involved in administrative and regulatory work, and in statistical data gathering activities. Limited mobility and input funding for trials and demonstrations, and low remuneration do not provide the necessary incentives to visit farming communities on a regular basis. As a result, farmers receive inadequate advice on the latest crop production technology. Furthermore, the staff has not been trained in farm management economics and is generally unable to prepare crop or farm budgets[17].

Summarizing, the agricultural extension organization network in the country consists of:

1.State system for agricultural extension:

* At the central level: Department of Agricultural and Forestry Extension;
* At the provincial level: 61 Centers for Agricultural Extension (100% of provinces and cities);
* At district level: 377 Stations for Agricultural Extension (70% of districts); and
* At local level: extension workers in 30% of communes.

2.Agricultural Extension system of research institutes and universities;

3.Voluntary agricultural extension system of farmers' organizations and NGOs; and

4.Extension work by supply companies (agro-chemicals, seeds, others).

## I.3-Recent major research and extension approaches

### *I.3.1-Cropping systems research and extension*

The establishment of appropriate cropping systems is found to be an important approach to obtain optimum crop productivity, and to minimize the constraints caused by natural and socio-economic factors. Vinh (1992) suggested eight variety systems for rice and other main crops grown in Northern Vietnam, adaptable to different ecological conditions:

1. Cropping systems involving rice varieties tolerant to acid phosphorous deficient soils.
2. Cropping systems involving short duration varieties of rice crop.
3. Cropping systems involving drought tolerant varieties of rice crop.
4. Cropping systems involving deep-water tolerant varieties of rice crop.
5. Cropping systems involving rice varieties tolerant to flooding during summer crop.
6. Cropping systems involving rice varieties resistant to brown plant-hoppers and other pests and diseases.

[17] DAFE, annual report. Hanoi, March 1999.

7. Cropping systems specialized for intensive areas of rice crop production, and
8. Cropping systems involving high quality rice varieties.

The second variety systems (*short-duration varieties*) play a very important role in the RRD where three crops are grown in the year as a result of adopting the cropping pattern RICE - RICE - WINTER CROPS where possible.

*I.3.2-Research on variety systems*

In order to expand cultivated areas of early winter crops in the irrigated land, a series of improved rice varieties including of high yield and short-duration varieties namely CR203, CN2, VX64-83, etc., has been selected, tested and then recommended to the farmers.

For winter crops, researchers have been able to develop useful recommendations for improving crop varieties such as maize (No.2, No.6, MSB49, Hybrid varieties, etc.), potatoes (VCS.1, LT7, I1039, VC386, VD2, etc.), sweet potatoes (Hoang long, VX37-1, Bi, No.59, etc.) and vegetables (cabbages, kohlrabi, cauliflower, etc.). The achievements have been also recognized in the RRD by wide application of early-maturing and high yielding varieties of winter soybean such as V74/DT74, AK02, AK03, VX9-3, etc. (Linh, 1996).

*I.3.3-Research on improved technologies*

Agricultural research in the RRD also recommended methods of planting, weed, pest and disease control, fertilizer application, irrigation management, harvesting, storing, and processing of rice and other crops. For example, since 1986 the research programs on food legumes have been established, including research on food legume breeding, and improved technologies for food legume intensive farming. The breeding research consists of germ-plasm collection and evaluation, variety screening and on-farm testing, seed multiplication and developing new varieties to production including soybean, groundnut, mung-bean, etc. In principle, the arrangement and techniques to be applied for winter crops must ensure the high yield of previous crops.

*I.3.4-Studies on processing and marketing of agricultural products*

With the focus on cropping systems, new crop varieties and animal breeds, and methods and techniques of production, less attention was paid to processing and marketing agricultural products in the RRD, especially with respect to fruit trees and winter crops such as potato, sweet-potato, soybean, vegetables, etc. Socio-economic and policy-oriented research on winter crop production and utilization, as well as economic analysis of the technology, has not been adequately done.

## I.4-Strategies for Agricultural Development in the RRD

In 1991, the VII National Congress of Vietnam established the *Strategy for Socio-economic Stabilization and Development to the year 2000* (MARD, 1996). Basically, the RRD continued to be targeted as a key area for the production of staple and non-staple foods, short-term cash crops, fruit and livestock and for the development of rural industries and services. Agricultural processing will receive specific emphasis. The specific RRD Action Program concentrates on intensive food crop production and some attention is given to the development of new fruit crops and improved winter crops in conjunction with the processing industry. The major objectives are following:

### *I.4.1-Paddy Intensification Program*

#### I.4.1.1-Changing Area under Paddy

Due to increasing urbanization and growing demand for diversified agricultural products such as vegetables, fruits, livestock and poultry products, a shift in land use pattern was observed in the early part of 1990's and this trend will continue in the coming years. Hence, the area under paddy will decline with little potentiality of additional land reclamation in the RRD. It is expected that the area under paddy will slightly go down from 1.042 million hectares in 1995 to 1.035 million hectares in 2000.

#### I.4.1.2-Growth of Productivity of Paddy

The main options left to increase paddy productions in the RRD are increasing yield per hectare and improving land use, that is, cropping intensity.

#### I.4.1.3-Promotion and Efficient Use of New Technologies, Inputs and Water Resources

One of the other major factors governing the impressive growth in food production was the use of improved technologies. The use of new technologies helped to create new opportunities for improving yield, quality and efficiency of agricultural production.

#### I.4.1.4-Use of Improved and Hybrid Seeds

Breeding and selection of improved varieties of paddy will be carried out. Hybrid[18] varieties will be extended to the north (compared with improved varieties in the south) on a priority basis. In addition to improvement of varieties, efforts will be made to achieve an optimum rate of seed use.

[18] Hybrid rice is seen as better growth under farmers' conditions in the North than that in the South of Vietnam. At present, hybrid rice varieties are mostly imported from China. Very high price of seed is one of major constraints that results in low rate of hybrid rice adoption.

*I.4.2-Ensuring adequate food supplies and access: Agricultural Diversification Program*

One of new ideas of the program document indicated that the agricultural diversification program plays an important role in increasing the efficiency of agricultural production in the country. According to this document, diversification for the RRD can help to achieve the following results:

- Increase in farm household income which increase access to food;
- Create more jobs and reduce the underemployment of labor force in rural areas thereby enhancing access to food;
- Meet demands for diversified farm products due to growth in income in the non-agricultural sector;
- Create favorable conditions to make better use of farm resources resulting in increase in productivity;
- Improve nutritional standard of the farm household members;
- Develop an ecologically balanced agriculture.

Description of the program document also argues that on the whole, the successful agricultural diversification program not only raises agricultural outputs, but also increases the access to food. The definition of food security now is not only expressed in terms of sufficient paddy for the people, but also in terms of other products. Under conditions of open market economy, higher incomes of the people will guarantee their food security.

Maize is one of the major subsidiary crops whose production increased at an annual rate of 15 per cent during the period 1990-1995 in the RRD. The acreage under this crop had gone up by 4.5 per cent annually. Its yield increased by more than 10 per cent per annum. In the North, the winter maize crop achieved good progress. Some of the major reasons for high rate of growth of maize production were the application of imported improved varieties and local hybrids and the growing market demand for maize as livestock feed. In addition, potato can be seen as another important winter crop in the RRD. Although efforts have been made, the expansion of potato cultivation is not satisfactory, as a result of both technical and socio-economical problems.

Some cash crops, such as soybean and groundnut achieved significant growth in both yield and cultivated area in the early part of the 1990's. The area under the soybean and groundnut crops has increased by 5 per cent and 4 per cent annually, respectively. The major factors behind it were high demand for these products as the ingredients of livestock and poultry feed, and for export.

The country has experienced some progress in the field of agricultural diversification particularly since 1989. However, the progress was slow. The important reasons for the slow progress can be summarized as follows:

1) Problems of food insecurity and productivity of food crops were seen as core issues for designing any project activity when most of farmers in the RRD seemingly do not face these problems anymore;
2) Lack of necessary information from farmers in the region to understand what are farmers' interests and what they are doing in the field of diversification;
3) Inadequate supply and lack of quality input such as improved varieties, animal breeds, fertilizers and feed;
4) Inadequate number of field extension staff with competence to do their tasks and lack of clarity about their responsibilities;
5) Insufficient irrigation facilities;
6) Less attention to improvement of processing, marketing and input support services.

*I.4.3-Increasing productivity and output of agricultural products: Strengthening Agricultural Research and Extension Systems*

The strategy for improving research and extension activities in coming years has been designed as follows (Binnie *et al.*, 1994):

1. Intensification of farming and increase of cropping intensity;
2. Studies on selection and creation of high yielding crop varieties;
3. Studies on technical measures of intensive farming to improve the yield and product quality;
4. Studies on improved technology for exploitation and conservation of water resources and effective uses of existing irrigation and drainage facilities;
5. Research on the promotion of agricultural diversification;
6. Extension programs to support seasonal-crop changes;
7. Extension programs to introduce new varieties;
8. Extension programs to improve production technologies;
9. Extension programs on plant/animal protection;
10. Reorganization and restructuring of research institutions;
11. Improvement of inputs and credit supply and marketing and processing of products;
12. Increasing the decision making capability of farmers; and
13. Helping farmers to establish effective farmers' organizations.

However, the detailed contents of each item mentioned above are not well explained and sometimes not clear enough.

## II-Research problem and hypotheses

### II.1-Problem Statement

Most agricultural research in Vietnam has understandably been technical in nature. There is very little research of innovation and policy formulation processes. Hence, there has been little reflection on how research and extension organizations interact with farmers to facilitate agricultural development that is sustainable. Few research and extension organizations have formulated clear principles, targets and goals, clear methods of monitoring their impacts, or have established procedures for improving their responsiveness to farmers' needs.

The debate in the Ministry of Agriculture and Rural Development (MARD), the Ministry of Technology, Science and Environment (MTSE), and other related institutions over methods, procedures and approaches, has failed to distinguish clearly between strategic choices available to research institutes and extension agencies. Each agency faces its own pressures, draws on its own experiences, and has its own views of priorities and possibilities. That results in a confusion, not only on the ground, but also in the minds of financiers, policy makers, and research and extension program managers about what exactly they are targeting to achieve with research and extension. The room for research and extension policy choices in practice has been pre-empted by explicit or implicit agricultural policy choices and the specific, local functioning of other forces in rural development, such as the market and the price of products. Policy makers remain unaware of the situation in the field and of the barriers to making realistic policies. This results in the lack of policies that are enabling, and create conditions for sustainable development based on locally available resources and local skills and knowledge. In this context, the question of a significant gap between the ways individual farmers and institutions make policy decisions and the available knowledge on how policy can be made, must be addressed.

This social problem leads to the following research problem: Official policies are based, whether explicitly or not, on ideas about "what works" in term of stimulating agricultural innovation. These theories can be made much more explicit and contrasted with an analysis of innovation processes actually taking place in farming communities. From this comparison it is hopefully possible to formulate more effective theories about innovation to underpin agricultural policy and intervention, and to identify procedures by which state capacity to assist farmers can renew and respond to farmers' needs.

### II.2-Hypothesis

This project uses case studies of innovation processes in the densely populated Red River Delta, and of official models of agricultural innovation, to develop theories to underpin technology

(agricultural research and extension) policies of Vietnamese organizations. The overall hypothesis is that the innovation theory currently underpins agricultural technology policy in Vietnam does not adequately reflect the dynamic processes that take place in the field in the context of the (new) open market economic system.

## III-Justifications and research objective

The RRD has about 1.2 million hectares with 16 millions inhabitants, i.e., its population is about the same size in the Netherlands on an area of land about ¼ the size of the Netherlands. The growth of non-agricultural employment has not yet taken off, so that most of the population growth still need to be absorbed by agriculture. The average farm size is of 0.3 ha and rice growing is obligatory. In recent years, as a result of policy liberalization, productivity of rice production has increased from about 2 to about 6 tons, or with two crops in a year, 12 tons/ha/annum. This allows farmers to adequately serve their own food needs and still have some surplus (the RRD actually produced a rice surplus of about 200,000 tons in 1999 - MARD estimated). In this situation, farmers see opportunities to develop winter crops (sometimes two winter crops in addition to the two main rice crops are grown), and to reduce their rice acreage in favor of other crops. Given the dynamic situation, the official research and extension system is not always able to effectively respond to farmers' needs.

There are many research and extension projects, but the results are often not successfully applied by farm-households. Adoption rates have been disappointingly low. Meanwhile farmers are busy in innovating their farming systems in their search to improve their very low income. Somehow, the state apparatus is unable to effectively assist farmers in their efforts. Seemingly this is due to the mono-disciplinary research approach and the lack of attention to farmers' needs. Farmers' incomes continue to be low, and poverty in rural areas is a concern of both local and national governments. Even with many farming families applying more productive and environmentally sound farming systems, the trend of high costs for production inputs and low prices of outputs prevents them from taking advantage of many opportunities. Most successes are still localized. The adoption rate of innovations has been disappointingly low in many of areas, as shown by the expansion of winter crop production or in the case of changing land use systems in the RRD. This is partly because a favorable policy environment in terms of both research and extension is missing. In addition, the contradictions between land, labor, and employment in rural areas are becoming fiercer, inevitably leading to lower incomes. The slow developments of rural industries and services have so far failed to absorb redundant labor from agriculture.

There is increasingly a debate that community skills and social organizations have direct impacts on the use of locally appropriate technological innovations as these relate to sustainable

resource management. However, from the local to the national level, research and appropriate knowledge on these issues is still limited, and the answers are not always known. There is a tendency for a top-down approach in research and development, with one-way communication, resulting in low efficiency. In addition, government policies on agricultural research and extension are often not very clear, or are inadequate or misdirected when devised following top-down procedures (see also Xuan, 1996).

As mentioned above, the majority of the national research institutes and the agricultural universities are located in or near Hanoi City. Research and technology transfer in the last decade has helped in the intensification of farming, particularly paddy, and in achieving some progress in agricultural diversification. However, if paddy production is even more productive, but all farmers produce paddy on a small acreage, the poverty is not alleviated and the farmers need to move to high value crops. Marketing of these products will become the problem. This study will look at what farmers are doing, their strategies, their concerns, and the way they try to solve their problem of low income (for example, changing land use systems, expanding winter crops, doing off-farm jobs, growing high value crops, marketing, adding value to their products such as processing, etc.).

Although a certain progress has been achieved, there are constraints in the establishment of an effective agricultural research and extension system as follows (hypotheses):

* The research organizations are too many and scattered with an overlap in tasks;
* The focus on single-discipline research with practically no interdisciplinary efforts, with little farm management and farming systems research for which the greatest need exists;
* Very little on-farm research to verify on-station findings, and from which extension recommendation should be formulated;
* Lack of farmers' involvement in management and control of the research and extension system;
* Lack of responsiveness for resolving the farmer problem of low income;
* Weak linkage between research, extension, farmers and other related actors in solving farmers' problems;
* The large number of older researchers and extension workers with insufficient updated training in modern research and extension techniques and approaches;
* The provision of incentives to workers involved in research and technology transfer is inadequate;
* Inadequate number of field staff for extension activities, etc.

The problems of research and extension activities in the RRD show that the task of policy formulation requires more than reflection on past practice, or clearer principles for guiding the design of research and extension approaches. Farming households are engaged in cross-ecosystem, diversified farming in terms of land fragmentation, diverse crop/animal types and crop/livestock patterns and varieties, and often in non-farm activities. In the conditions of local diversity and specific needs of farmers, more attention should be given to the choice of the problem which research and extension may be asked to address.

At this moment, one can find very few research and extension organizations that have officially set out clear principles, targets and goals. In the absence of explicit research and extension policies for the region, the methods and approaches have forced choices that are sometimes not articulated with the agricultural policy environment. ***The main objective of this study is to look both at (1) farmers' innovation processes, and (2) official innovation theories and efforts, to diagnose the problem identified and suggest more effective policy theories and procedures for supporting farmers' innovation.***

The study may contribute to knowledge and understanding of the Agricultural Knowledge and Information Systems (AKIS) operating in the RRD and how it works. The objective is to capture needed knowledge and its significance for policy-making process in reaching sustainable development of agriculture in the case of the RRD. In addition, the study may significantly contribute to the process by which research and extension programs can be made to be more relevant to farmers' needs.

## IV-Methodology

Different people have different values. This raises critical issues for the methodologies I will use for finding out about implications in the process of technology development and extension. In recent years, there has been a rapid expansion in alternative systems of inquiry: Farmer Participatory Research, Farming Systems Research (FSR), Participatory Action Research (PAR), Participatory Technology Development (PTD), Rapid Appraisal of Agricultural Knowledge Systems (RAAKS), Participatory Rural Appraisal (PRA), Rapid Rural Appraisal (RRA), Soft Systems Methodology (SSM), etc. What should become central are the people themselves, rather than the 'tools' or 'instruments' (Pretty, 1994).

In this section, I can not discuss the appropriateness of all the methodologies that are supporting my study. This study is about research as a participatory process, about research *with* people rather than research *on* people. It is about inquiry as a means by which people engage together to explore some significant aspect of policy for technology development and extension, to better

understand and contribute to sustainable development of agriculture in the RRD. This study is based on case studies (see Chapter 4).

## V-Outline of the book

The study focuses on policy measures for the development of agriculture in the RRD, especially to agricultural innovation in the region. The structure of the study is follows:

*Chapter 1-Country background*: This chapter presents general information about the country of Vietnam with its different agricultural regions, economies and agricultural systems, policy and institutional reforms, and agricultural research and extension services in the last decade. The information also indicates issues of food security, agricultural diversification, and land-use rights in Vietnam. The last section of this chapter concerns government objectives for the development of agriculture and the rural economy.

*Chapter 2-Introduction*: This chapter provides some more detailed information about the Red River Delta as the region was chosen for study. From this information, the chapter formulates the social and research problems, and the hypotheses for the study. Justifications and research objectives are also presented in the chapter. At the end, the chapter briefly describes the methodology used in the study.

*Chapter 3-Research issues*: This chapter aims to build a theoretical foundation upon which the research is based by reviewing the relevant literature to identify research issues which are worth researching because they are controversial and have not been answered by previous chapters. The chapter discusses the knowledge system perspective and different approaches of technology development and extension. From these discussions, the chapter draws some implications for the study of agricultural innovation and technology policy. Research questions are developed at the end of the chapter.

*Chapter 4-Methodology*: The chapter describes the major methodology used to collect the data that will be used to answer the hypothesis. In this chapter, qualitative case study methods are presented.

*Chapter 5-Journey to the farm*: This chapter briefly presents information from the interview of eighty farmers in different locations of the RRD. This chapter describes farmers' opinions regarding issues such as their incomes, innovation, crop protection, sustainability of new farming systems, and research and extension work in the region. From this information, the reader can form an impression about the situation in the field, so as to get a better understanding of the research objective and the hypotheses presented in previous chapters.

*Chapter 6-Changing land-use systems in rice-based fields - a case of management of natural resources in Nam Thanh district, Hai Duong province*: This case presents farmers' innovation processes under conditions of scarce resources to deal with problems of low income and poverty. Thanh Xa commune is chosen as the study site where many farmers have been very dynamic and innovative in changing to new ways of farming. In this commune, while keeping a necessary land area for planting rice, farmers try to develop new models for horticulture and aquaculture in the farm. These models have presented their advantages, but also contain new challenges to the farmer. This case calls for assistance from research and extension to resolve farmers' problems.

*Chapter 7-New technologies and the choice of farmers - the case of True Potato Seed (TPS) production in the RRD*: The case presents government efforts in technology development to support winter crop production as a part of the diversification program. In this case, adoption of the TPS technology is still questionable because of the nature of technical aspects of the project itself. The case asks for a new research and extension approach that uses a knowledge system perspective to address problems of small farmers in the regions.

*Chapter 8-IPM in the RRD as a difficult task for extension*: The IPM Farmer Field School is seen as one good extension method to improve farmers' knowledge about their crop production. The IPM program in rice is designed to support the government strategy based on issues of food security by reducing risks of pest attacks and is less appropriate for satisfying farmers needs for a higher income. The farmer needs cash income through diversifying into many farming and non-farm activities. Expansion of cash crops in the winter season and changing towards a new farming system with the development of raised bed systems in farmers' fields needs to be incorporated into the IPM program.

*Chapter 9-Research and extension programs and farmers' opinions*: The chapter reviews strategies for research and extension in the region. In conjunction with findings on farmers' innovative activities in the previous cases, this chapter analyzes government efforts and issues to be argued in the process of making decisions about technology development and extension in the RRD.

*Chapter 10-Conclusions and implications*: This chapter presents conclusions about research questions, the research problem, and draws implications for theory, for practice and for further research.

## VI-Delimitation of scope and research location

The RRD is historically the original place where rice production in Vietnam took place, having the best rural transport and irrigation conditions. The RRD has the highest population density of 1,124 persons/km$^2$ in the country. In the region, the issue of food security is a major concern of local

authorities and also of the government. The scarcity of arable land is often the biggest constraint for the development of agriculture. Under conditions of a good irrigation network, the farmers have expanded their production in the winter season. Many of them are interested in changing the way of farming to effectively use the land resource and to diversify their incomes. Crop diversification is now becoming a movement that has attracted the attention of many actors. The study concerns issues of agricultural innovation and technology policy for the RRD. These involve some aspects of natural resources management, new technologies, IPM and theory for making policy on research and extension to be applied in the region.

This study mainly mentions crop production or farming systems as a whole. Less attention is given to specific aspects of animal husbandry because that is a very complex area and needs more time for doing the fieldwork.

Theoretically, with respect to technology development and extension, solutions for the development of agriculture in the RRD can be very useful for other regions of the country. However, the countryside of each region in Vietnam has different socio-economic conditions and farmers' circumstances vary from place to place. Therefore, findings of this study are mostly applicable in the RRD, but some theoretical aspects of technology policy and innovation maybe adapted to other regions.

The fieldwork has been carried out in the provinces of Thai Binh, Ha Nam, Nam Dinh, Hung Yen, Hai Duong, and Ha Tay. In addition, many discussions with officers working at MARD, MSTE and at research and extension institutions located in the RRD were conducted.

## VII-Conclusion

Policy reform has been seen as one of the very important factors supporting development of agriculture in the RRD during the last decade. As in the whole country, problems of food security, productivity of paddy crops, and exportable products in the region are the highest concerns of the government. Rice is the most important food crop grown twice in the year. The increase of rice production in the delta is facing challenges of limited land and a declining rice price, while rice productivity in some provinces seems to have reached its ceiling. This calls for a change in the research and extension approach for further development of agricultural production.

In recent years, research on the improvement of cropping systems in this area have been conducted together with few studies on agro-ecological conditions and socio-economic features. Considering diversified ecological conditions, various appropriate cropping patterns have been proposed, involving lowland rice and other crop variety systems that can give high and stable crop yields and expand winter crop production.

This research effort does, however, not adequately reflect the situation at the farm levels. Demand for increasing household incomes forces farmers in the region to look for changes in farming (see Chapter 5, 6 & 7). Crop diversification and higher income from a unit of land are major concerns for the farmers. In this context, changing land use systems in rice-based fields and the expansion of winter crop production can be seen as very important issues for policy for agricultural research and extension in the RRD. These trends, briefly outlined, suggest that the RRD, like much of the rest of the country, is beginning to put extreme pressure on the natural resources that constitute the basis for its livelihood and development.

Many of the development processes in agricultural production of the RRD are recognized as unstable and/or unsustainable. For instance, the production of vegetables for export demands a high level of chemical inputs, high quality of products as well as the need for good market development. Recently, the IPM program is widely seen as a good way to improve farmers' competence in production and to support the sustainable development of agriculture. However, in the RRD, this activity is now implemented only in specific projects that are mostly based on rice production. Options for research and extension towards the sustainable development of agriculture, both in terms of technical and social aspects, are seemingly not available in research and extension organizations. With respect to expanding winter crop production in the RRD, efforts from the existing research and extension programs based on resolving problems of cropping systems, variety systems and so on have had limited results. Many other socio-economic constraints, that result in the low rate of expansion of winter crop production and of changing land use systems, as in the case of potato and natural resources management, are not yet a concern for research and extension institutions.

This chapter laid the foundations for the study. It introduced the research problem and hypotheses. The research was justified, the methodology was briefly described and justified, the report was outlined and the delimitation was given. On these foundations, the presentation of the study proceeds with a detailed description of the research in the next chapters.

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# Chapter 3
# RESEARCH ISSUES

This chapter aims to build the theoretical foundation upon which the research is based by reviewing the relevant literature to identify research issues which are worth researching because they are controversial and have not been answered by previous chapters. The chapter discusses the knowledge system perspective and different approaches of technology development and extension. From these discussions, the chapter draws some implications for the study of agricultural innovation and technology policy. Research questions are developed at the end of this chapter.

## I-Abstract

Along with economic reforms, one of major challenges today for supporting the livelihoods of rural people in Vietnam is to strengthen the agricultural research and extension system. This would require that science policy place more emphasis on client-oriented, applied research and on the coordination of research and extension. However, the fundamental question is to what kind of research (basic and applied) the resources available for agricultural research should be allocated? How should current diverse and task-overlapping research and extension institutions be reorganized and managed? What values should influence the process of priority setting? How can we make research and extension more responsive to farmers' needs? And so on. In this debate, many scientists and program designers and managers still believe that there is only one problem: inadequate funding.

Agriculture has been described as a exceedingly complex system of biological, economical and institutional processes, and agricultural research is not the only source of increased productivity (Bonnen, 1987). The primary sources of increased societal capacity include technological change, but also institutional improvements, the increase in human capability, the growth of investments and market opportunities, etc. Many scientists and managers of research and extension program focus on technological advance to the neglect of the other forces.

As mentioned in the second chapter, this study examines innovation processes in the densely populated RRD, and of official models of agricultural innovation to develop theories to underpin technology (agricultural research and extension) policies of Vietnamese organizations. However, the examination of public policy is a very complex task, although here this process is limited to aspects of agricultural technology development and extension. It is widely recognized that there is a significant gap between the ways individuals and institutions make decisions and the available knowledge on how policy can be made. The process of technology development and extension can be seen as models of purposeful activity systems. Therefore, the study may benefit from the use of ideas of Soft Systems Methodology (Checkland, 1989) to initiate a debate about change and learn its way to changes which would be both (systematically) desirable and (culturally) feasible.

The study on related aspects of policy-making for agricultural research and extension needs to use a soft system perspective to define a problem of sustainable development of agriculture in the RRD according to various points of view, to draw an argument from many different sources. There is a number of theoretical issues surrounding the notion of research and extension policy towards sustainable development of agriculture in the RRD that needs to be explored when we enter the debate.

## II-Definitions

The key words used in this study are *productivity, innovation, policy, dynamic, sustainability, stability, equitability, technology, technology development, extension, knowledge system, and participation.* In order to limit the area of the study, some concepts need to be clarified:

Many definitions of ***sustainability*** have been constructed emphasizing different values, priorities and goals. Sustainability itself is a complex and contested concept, and precise and absolute definitions of sustainability, and therefore of sustainable agriculture, are impossible to formulate (Pretty, 1998). This section is not to confront the task of defining sustainable agriculture, but review its aspects in relation to technology development and extension in the RRD.

By the mid-1980s, the sustainability concept was diffusing rapidly from the confines of its agro-ecological origins to include the entire development process. The definition that has achieved the widest currency was that adopted by the Bruntland Commission: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*"[19]. Socially, sustainable development should attempt to offer a chance of overcoming the current problems of poverty in a way that allows all people to make a better living without endangering the environment.

[19] World Commission on Environment and Development, 1987, p. 43.

However, this definition is so broad that it is almost devoid of operational significance. In the sense of technology development, we are in the process of completing one of the most remarkable transitions in the history of agriculture. In the past, almost all increases in food production were obtained by bringing new land into production. This process of growth in agricultural production within the framework of what has been termed the "resource exploitation" model clearly is no longer sustainable. By the first decades of the current century, increases in food production must come from higher yields - from increased output per hectare. The trends of declining food prices suggests that productivity growth has been able to more than compensate for the rapid growth in demand arising out of growth of population and income. People diets are changing from necessary to high value foods, and this requires a higher quality of agricultural products such as milk, fruits, meat, vegetables, etc.

One of our concerns is the ability to design an adequate technological or institutional response to the issue of how to achieve sustainable growth in agricultural production.

Under conditions of limited natural resources as in the RRD, "agriculture is becoming increasingly driven by technology" (Röling, 1990). The technology hopefully maintains or increases biological and economic productivity, enhances efficiency of input use, increases stability of production, increases resilience to environmental change, minimizes adverse environment impacts, and ensures social compatibility (Lightfoot & Noble, 1992). Maintaining a high production potential and making optimal use of locally available resources can support the sustainable development in the delta. Moreover, in the RRD where non-farm employment opportunities are not yet available for surplus labor forces from agricultural sectors, technology development is seemingly becoming an important strategy to support agricultural production of farmers. In addition, technology development will usually increase labor productivity in agriculture. So, it will decrease employment in agriculture, in other words, release labor now used in agriculture for more productive work if that is available. However, technology development is likely to make farmers poorer because advantages of technological change in agriculture are usually passed on to middlemen and consumers (Cochrane, 1958). That requires a major shift in our thinking as regards the range of technology and value adding to be enlisted for development.

The fact is that the expansion of agricultural land in the RRD is impossible (see Chapter1&2), almost all arable land is used and tends to be reduced because of population increase, industrialization and/or urbanization. Increasing the value added per unit of area therefore is becoming the concern of the farmers. This value added includes productivity and price of the product. Increase in agricultural productivity is possible through (i) increase of production per hectare, (ii) increase of production per

man-day, and (iii) increase of production per '000VND[20] invested. Most research in the region focuses on the first indicator, whereas last two indicators are also important. As mentioned, most of cultivated lands in the region are devoted for planting rice crop and the rice yield seems to "reaching at ceiling". The farmers can not improve their incomes by producing commodities such as rice more efficiently because the rice price is steadily going down (IFPRI, 1995; GOS, 1999). They can not win this race, although many new technologies have been introduced and adopted. In addition, we already know that the farm size in the region is very small. It is proposed that the development of agriculture in the RRD requires farm size to increase (enlarge scale). This process requires employment opportunities outside agriculture and needs more time to make an impact. Another option is for the farmer under certain conditions to plant high value crops or animals instead of rice, and to add value through marketing and processing products.

The model of research and extension in the RRD focuses on technology transfer, in which the research produces new technologies and extension transfers them to the farmer to be applied. This might, however, not be a good approach when farmers are experts (see Röling & van de Fliert, 1998) and free agents on the market, and seek to capture diversity and opportunity by their farming. The situation in the region now requires a different role of research and extension.

Dimensions of sustainable development include social sustainability, economic sustainability, maintenance of the soil and the genetic resource base, minimization of environment pollution, and lowered the use of chemical inputs (Harwood, 1987). In the conjunction with agro-ecosystem perspective, it is suggested by Bebbington and Thiele (1993) that even if there are technical successes, problems with the agro-ecological approach may persist in the long-term, because of lack of markets for the products of such systems. Ruttan (1982) argued that the farmer can be viewed as an actual or potential victim rather than as a beneficiary of the new technology. The study of Cochrane (1958) also showed that "the wide-spread adoption of new technology changes the entire situation. Total output is now increased, and this increase in the supply of the commodity lowers the price of that commodity." This situation leads gross returns to the producers to fall. As he said, it is very easy to see why the first farmers undertake a new technology. They benefit directly. And we can also understand why neighbors of the enterprising first farmers adopt the new technology: they see the income advantage and try to do it. But, as more and more farmers adopt the new technology, output is affected and the price of the commodity declines while unit costs of the production are unchanged. So in the long run, by the time most farmers have adopted the technology, the income benefits that the first farmers realized have vanished. Therefore, the market-driven process has led also to the unsustainable type of farming we face today (Röling, 1997; Röling & Jiggins, 1998).

[20] '000VND = thousand Vietnamese Dong.

Another concern is Engel's (1997), that sustainable technologies are a necessary, but not sufficient condition for sustainable agricultural development. Such development can only be achieved where and when people have worked out a way to live with each other. This leads to the perspective that we can not look at farmers or researchers, extension workers, or policy makers alone to re-orient and re-organize innovation in agriculture. Sustainable development of agriculture requires the involvement of all of them. In addition, Röling & Jiggins (1998) see conditions for sustainable agriculture that are created in the socio-sphere, through *policy*, *institutional* and *behavioral* change. In this context, the sustainable development of agriculture in the RRD will also require that farmers participate in research and extension programs, and have a long-term impact on the programs. The key measure will focus on how small-scale farmers can manage the programs by themselves. The implication is to minimize dependence on these programs.

Coutts (1994) recognized that the meaning of the term ***'policy'*** per se has been subject to confusion and lack of clarity. He cites the opinion of Bardes & Dubnick (1980) with respect to this problem when attempting to approach the phenomenon called public policy. They argued that the debate over a definition of public policy could itself fill a volume. For their purpose (looking at motives and methods in policy analysis), they made the assumption that, in very general terms, public policies are government actions or statements, although they acknowledge a lack of a definitive boundary or substantive core for the field.

House and Coleman (1980) define government policies as a governing plan, or course of action made by an authority in a government entity. Schaffer (1984) referred to the public policy agenda that he described as the constrained list of the items or issues about which choices have to be made. Colebatch (1993) highlighted the continuing lack of clarity on the meaning of public policy: In all of this discussion, there has been little attention given to "policy" as a concept, its meaning, and its relation to other terms, and to political activity. He described three dimensions of policy: (i) policy as decision-making; made by those in authority in response to public problems; (ii) policy as the structuring and building of commitment, across organizational boundaries; and (iii) policy as the interpretation of actions, facilitating discourse among a range of participants in the process. In this study, policy is understood as a government concern in which research and extension agencies are trying to implement government policies through research and extension programs.

The study does not strongly emphasize the examination of the detailed content of specific policies, or resource allocations; nor evaluations of their consequences. More attention will be paid to the generation, utilization and relations of knowledge sources in the policy-making process. This idea started from Long & Long (1992) who suggest that knowledge generation and utilization are

not merely matters of instrumentality, technical efficiency or hermeneutics; but involve aspects of control, authority and power that are embedded in social relations.

The meaning of ***'technology'*** is also debated. In 1977, Stewart noted that there is a widespread tendency to identify technology with the 'hardware' or the quantifiable elements of production, i. e., the material objects such as tools and inputs, their quantity, type and timing, and thus to ignore knowledge and skills as important aspects of technology. In their field, Byerlee & Collinson (1980) defined a technology in agriculture as a combination of all the management practices for producing or storing a given crop or crop mixture. Timing, amount and type of various technological components such as seedbed preparation, fertilizer use or weeding define each practice. Other authors recognized the importance of the "knowledge and skills component" of technology (Mazur & Titilola, 1992).

Rogers (1983, 1995) sees the term ***'innovation'*** as an idea, practice, or object that is perceived as new to an individual or another unit of adoption. He has argued that newness in an innovation need not just involve new knowledge. Someone may have known about an innovation for some time, but not yet developed a favorable or unfavorable attitude toward it, nor have adopted or rejected it. 'Newness' of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt. A technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome. As argued, a technology usually has two components: (1) a *hardware* aspect, consisting of the tool that embodies the technology as a material or physical object, and (2) a *software* aspect, consisting of the information base, the institutional and policy conditions, and the knowledge and organization, regulations for using the tool. The process of innovation must be viewed as a series of changes in a complete system not only of hardware, but also of market, environment, production facilities and knowledge, and the social context of the innovation organization.

Our study tries to follow not only specific innovations, but also uses a 'soft' system approach for looking at the "theatre of agricultural innovation" (changing land-use system relating to changes in farming), i.e., at the network of related actors. That includes creating a "rich picture" of the multiple perspectives held by the different stakeholders when trying to look at a common problem, and finding solutions and actions. By working back from the successful use of an innovation, its path can be traced. It would also be useful to try to find out what had happened to the problems that did not set solved for which or innovations that did not make it though the system. Using an AKIS approach requires using the theory as an overlay that allow one to compare the theoretical model with what actually exist in order to identify institutional and functional gaps in the system.

Another question is why the study deals with research and extension policy, but not with separate terms (for example, research policy or extension policy)? It is argued that although there

are differences in the nature of the two activities, in their objectives, and in the knowledge and resources they mobilize to achieve these objectives, research and extension are seen as components of a system. Castillo (1995) called for a 'new research paradigm' that does not allow for a clear distinction between research and the "transfer" of its results. Dunn, *et al.* (1996) proposed that extension should be a part of the research process rather than the final step in the adoption of research findings, and that farmers are willing and able to participate in these processes, especially where complex agricultural and environmental issues are at stake. This study will pay attention to the research and extension policy to serve sustainable development of agriculture in the RRD.

## III-Positioning the knowledge systems perspective

In the development process, emergence is seen as an important phenomenon (Checkland & Scholes, 1990; Röling, 1997). Emergence refers to the idea that the whole has properties that can not be fully understood in terms of the properties of its component parts. An emergent property of a system is defined as a property which is only visible at the system level and which cannot be predicted from the elements making up the system or even their relations (Checkland, 1981). Innovation is an emergent property of a soft system; that is, it emerges from the interaction among the social actors who form a soft system to the extent that they collectively begin to see themselves as forming such a system (Röling & Jiggins, 1998).

Another consideration is that any research and extension approach or methodology should aim at facilitation that is enabling instead of controlling relevant processes in order to encourage the participation of all related actors. It assumes an innovation related process to be largely self-guiding, but also affected by the opportunities and constraints inherent in the way actors are organized. At the same time, it presumes that no single actor can develop a fully comprehensive view of all processes relevant to innovation (Engel, 1997). This implies that systematically analyzing aspects of policy for technology development and extension in relation with farmers needs to apply a perspective that focuses on sharing knowledge among relevant stakeholders rather than simply on research and extension efforts. That leads to the choice of knowledge systems perspective in this study.

### III.1-The Continuum of Knowledge and Innovation Process

Knowledge is constituted by the ways in which people categorize, code, process and imputes meaning to their experiences. Knowledge emerges out of a complex process involving social, situational, cultural and institutional factors (Arce & Long, 1992). Decision-making is seen as a knowledge-intensive activity (Holsapple, 1995). In this view, there are some major types of knowledge that are important for study of decision making and policy: procedural knowledge to "know how";

descriptive knowledge to "know what"; and reasoning knowledge to "know why." Chambers (1994) argued that knowledge is not just a stock, but a process. The issue is not just 'whose knowledge counts?' but 'who know', 'who has access to what knowledge' and 'who can generate new knowledge and how?'

The studies of Kline & Rosenberg (1986) and Verkaik (1997) see (*commercial* and *technological*) innovation as is neither smooth nor linear, nor often well behaved. Rather, it is complex, variegated, and hard to measure. One now cannot say that: one does research; the research then leads to development of technology; and development to production and production to marketing. The design process of innovation needs feedback, trials and re-design for an ultimate success. They also indicated: "the two main components of science that affect innovation are: (i) the current totality of stored human knowledge about nature, and (ii) the process by which we correct and add to that knowledge". They recognized that most innovation is done with the available knowledge already in the heads of the people in the organization doing the work, and, to a lesser extent, with other information readily accessible to them. Modern innovation is often impossible without the accumulated knowledge of science and implicit development work often points up the need for research, that is, new science. Hence, research is not the source of agricultural innovation. Successful technological innovation is a process of simultaneous coupling at the technological and economic levels (Kline & Rosenberg, 1986). The process of innovation can be seen as changes in a complete system of not only hardware, but also market environment, production facilities and knowledge, and the social contexts of the innovating organization.

## III.2-The Knowledge System perspective

Knowledge systems can be defined in two ways: (i) as stable cognitive patterns, for example as in "indigenous knowledge systems", and (ii) as configuration of (institutional) actors, such as farmers, agricultural research institutes and extension agents, in theatres of innovations, who can potentially collaborate to enhance synergistic innovative performance (Röling, 1988, 1992 and 1997; Röling & Engel, 1991; and Engel, 1997).

The knowledge system perspective emerged to inform knowledge management for improved innovative performance, especially in agriculture (e.g., Haverkort & Engel, 1986). Knowledge system thinking took off from the conventional, but powerful 'linear model' of innovation (Kline & Rosenberg, 1986). The linear model was consistent with positivist assumptions, in that technology was seen as applied science and scientific research as fountainhead of technological innovations. These innovations were 'delivered' by extension agents to farmers who perceived as 'users'. The linear model was supported by Cochrane's (1958) model of the "agricultural treadmill" which predicts that market forces will propel the adoption of efficiency-boosting innovations. Early innovators will capture

windfall profits while those who adopt relatively later are forced to do so when productivity gains are passed on to agri-business and consumers in the form of lower prices. Another research tradition which fitted the linear model was the 'diffusion of innovations' (Rogers, 1983 and 1995), which features literally thousands of empirical studies of the spread of technical innovations among populations, usually after having been introduced by 'change agents'.

Röling (1994) developed knowledge system thinking in the direction of collective natural resource management by intervening 'platforms for land use negotiation'. These platforms are new forums for decision making at levels of social aggregation commensurate with the system level of the natural resource at which collective action is perceived to become indispensable such as in areas of changing land-use systems in the RRD.

**Table 5 - Matrix of knowledge system thinking**

| | TOT[21] according to linear model | Advisory work to improve farm management | IPM facilitating ecological sound agriculture |
|---|---|---|---|
| Farm practices | Utilizing science-based uniform component technologies | Running a farm as a profitable business | Running a farm as a sustainable locality-specific eco-system |
| Farmer learning | Adoption | Information processing | Becoming expert at observation, inference, anticipation, and application of agro-ecological principles in group learning process |
| Facilitation | Transfer | Advisory work by consultant, facilitating farmers' learning of decision making | Participatory non-formal education based on discovery and experimental learning |
| Institutional support (AKIS) | Institutions 'calibrated on a science-practice continuum' | Network of information services and support companies | Decentralized and interconnected learning network of trained farmers and facilitators |
| Conductive policies | A system to supply fertilizers and pesticides, high investment in public agricultural research and extension | Subsidies on credit, export promotion, infrastructure development, support of liberalization | Prohibition of pesticides, levies on nutrient emissions, removal of subsidies on chemical use, protection of green labels |

Other aspect of knowledge system thinking, which contributed to the framework for analysis in this study, is the invention of the 'ecological knowledge system' (Röling & Jiggins, 1998). The ecological knowledge system emerged out of the analysis of efforts to introduce sustainable agriculture, especially the introduction of Integrated Pest Management (IPM) in rice by FAO in

[21] TOT: Transfer of Technology

Indonesia (Röling & Van de Fliert, 1998). This analysis shows that a totally different knowledge system for (i) Green Revolution style of 'technology transfer' of component high-input technologies according to the linear model, (ii) advisory work to improve farm management, and (iii) facilitating ecologically-sound agriculture. The matrix in Table 5 provides an overview.

The use of knowledge systems perspective, developed by Röling and others at Wageningen University (Röling, 1988; Engel and Salomon, 1997; Röling and Wagemakers, 1998), hopefully provides an institutional approach that looks at sets of inter-connected actors who play different, but complementary roles in the process of formulating and executing research and extension policy with a view to enhance innovative performance.

It is common to consider the institutions involved in the communication which takes place between agricultural research and extension and the farmers as comprising a "system" (Cernea *et al.*, 1985; World Bank, 1985; Röling, 1988; Kaimowitz *et al.*, 1989; etc.). Kaimowitz *et al.* (1989) argued that such systems could be analyzed from an institutional as well as a functional perspective. The institutional perspective implies a focus on the institutions or actors involved in the system, the resources they command and the linkage mechanisms through which they interrelate or communicate. The functional perspective, on the other hand, implies a focus on the activities, tasks or functions performed by the participants of the system, which are needed to make the system achieve its goal. The realization that one can not think in terms of watertight compartment of creators, disseminators and users of agricultural knowledge, has led to the use ideas of agricultural knowledge and information system (AKIS) in this study.

The knowledge system perspective has potential for looking at agricultural innovation as a social effort, requiring a collective competence of mutually articulated actors rather than the sum of individual competencies. The knowledge system perspective looks at the institutional actors within the arbitrary boundary of what can be considered as a "theatre of innovation" (Salomon & Engel, 1997), as potentially forming a soft system (Röling & Jiggins, 1998). Röling (1990) also pointed out that it is a practical approach that sees its goal as the improvement of the management or design of the AKIS so that it functions in a way seen as desirable by policy makers, farmers, and other participants.

An important consideration in this study is that the examination of technology development will not see farmers as recipients or clients of the process. As remarked by Kaimowitz *et al.* (1989), a system of agricultural technologies consists of all individuals, groups, organizations and institutions engaged in developing and delivering new or existing technology. When using the AKIS perspective, the study will concern the objectives and existing knowledge of the groups or institutions involved, and interrelations between one set of objectives and knowledge and another,

the influences and different interests between them. The study also looks at the level of knowledge transformation, communication and data such as the flows of information that occur between the elements of the system, processing the information, the observation and data collection and the production of information and the utilization of information.

Instead of the linear model, the use of AKIS perspective in this study will help in diagnosing the disorders of the existing research and extension efforts in the RRD and in identifying the way to improve them. As an example, the research-based recommendation for farmers' behavior for which the required inputs are not available to many farmers can be seen as a lack of system perspective in terms of the conditions essential for technology utilization. This study hopes to create the ability to find new methods to encourage and enable farmers themselves to meet and work out what they need and want. The way to contribute to improving the research and extension activities in the region is to give farmers more power over them. As Cochrane (1958) has shown, the development of technology and its wide adoption by large numbers of farmers may lead to an over-supply, so that farmers collectively may lose as a result of their efforts. The situation with over production of winter crops such as tomatoes in 1970's, of garlic early 1980's in Hai Duong province has been a warning for what might happen if farmers try to change their cropping patterns or ways of farming when the market is unpredictable. Component technologies on which research and extension have tried to focus and which they introduce to farmers in the region are not always advantageous. The use of AKIS perspective will provide an overall view of the development of agriculture in the RRD where a dynamic process of innovations taking place in the context of the (new) open market economic system. What Cochrane said more than forty years ago is still valuable for farmers and research and extension programs in the RRD, unless it is used to prevent an increase in productivity. Productivity and poverty are two sides of the same coin.

Some people who use the AKIS concept have the notion that farmers are experts (see IPM program)[22] who, armed with their own indigenous technical knowledge and properly motivated and organized, will be able to develop much of the agricultural technology that they need. Although most of the knowledge needed for high productive agriculture today, such as the development of high yielding varieties, bio-technologies, etc., comes from research, it is desirable to understand why farmers in the RRD try to develop their own innovation. A study using the AKIS perspective for a certain field of agriculture in the RRD (for example, winter crop production and changing land use systems) aims to suggest how the functioning of this system can be improved. It also tries to understand how the competence of farmers with their resources can produce what the market requires at a low cost. Knowledge and understanding of an AKIS can also support the decision making by other

[22] Farmer as expert is one of principles of the IPM program

actors in the process of agricultural development (Van den Ban, 1993). In the AKIS perspective, two-way exchange of information is crucial for effective generation and transfer of relevant technology.

## IV-Different approaches of technology development and extension

This study will look at previous analyses of three major approaches in agricultural technology development and extension, and emphasis will be placed to an approach called "the new research paradigm" (Castillo, 1995).

### IV.1-TOT model

The Transfer of Technology (TOT) model of agricultural research is typical of both national and international agricultural research systems. Haverkort *et al.* (1991) noted that "Transfer-Of-Technology" is based on optimism about western science and technology and holds the assumption that there is a large stock of sound scientific information and technology ready to be transferred from researchers to farmers. In this view, it is the farmers' characteristics such as class, age, education, attitude, access to resources, etc., that determine the rates of adoption, rather than the inherent quality of the technology or the access of the farmers to inputs required. This approach generally has neglected ecological and environmental factors and assumes that they will, in the same form as the technology, ultimately adapt the technology introduced to the farmers.

As well known, the approach of Transfer-Of-Technology has had an impact on the Green Revolution agriculture in irrigated areas in developing countries of which the RRD is one example. In this area, the conditions are such that relatively uniform practices, requiring high external inputs have been adopted. However, the impact of this approach in rainfed areas has presented its limitations because farming systems are complex, the environment diverse and the production prone to risks. The physical and economic conditions on research stations have, after all, been very different to those of resource-poor environment (Pimbert, 1994; Van den Ban & Hawkins, 1996; etc.). For many agricultural technologies developed within the TOT framework, failure rates have been and remain high. The research priorities often turn out to be wrong, the packages are rejected, the technologies do not fit, are non-sustainable or inequitable because of an emphasis on purchased inputs in resource-poor contexts (Chambers & Jiggins, 1987; Pimbert, 1994; etc.). The crisis of the TOT model has already led some agricultural scientists to explore new approaches that hinge on farmers' participation. Other approaches such as "Farming Systems Research" and "Participatory Technology Development" demonstrate that it is indeed possible to formulate programs or projects based on the demands of farmers.

## IV.2-Farming Systems Research

Most of the agricultural research is focused on the production of certain commodities, a crop or an animal. However, the farmer looks at his farm as whole and is interested in how each commodity can optimally contribute to this whole. Farming Systems Research (FSR) is an approach to the research and development of technology and practices. This approach views the whole farm as a system and focuses on: (1) the interdependencies between components under the control of members of the farm household; and (2) how these components interact with the physical, biological and socioeconomic factors not under the household's control (Haverkort *et al.*, 1991; Bunders *et al.*, 1991; see also Norman *et al.*, 1995). Farming systems are defined by their physical, biological and socioeconomic setting and by the farm family's goals and other attributes, access to resources, choices of productive activities (enterprises), and management practices. FSR attempts to understand the farmers' indigenous practices, problems and opportunities; and is comprehensive in that it attempts to understand the whole farm setting. It is interdisciplinary in approach; complements existing research and development activities; is interactive and dynamic; and attempts to be responsible to both farmer and society goals (Shaner, 1982).

FSR gained widespread acceptance among research strategists and donor agencies in the late 1970s and 1980s (Bunders *et al.*, 1991), but it did not contribute as much to development as was expected twenty years ago. In the last decades, FSR evolved as a response to the need to identify opportunities for appropriate technology changes amongst poor farmers. Farrington & Martin (1987) characterize FSR as an applied "problem-solving" approach, conducted by multi-disciplinary teams, with a degree of farmer participation, where the perspectives of technology change are assessed within a holistic framework. It identifies homogeneous groups of farmers within specific agro-climatic zones as the clients of research. In the FSR approach, on-farm trials are carried out and the results of one year's trials generate hypotheses for testing in the next and should influence on-station research priorities. A problem is that it is difficult to generalize from the location where the study has been done to other locations, where one lacks the resources to do similar research.

FSR is often criticized for being still dominated by the Transfer-Of-Technology approach that does not focus on the problems and potentials of the resource-poor farmers, nor seeks to find unconventional technological alternatives taking into account the complexity and diversity of prevailing agricultural systems, etc. Efforts are now being made to re-orient the processes of agricultural technology development in such a way that sustainability and stability of the systems receive more priority.

## IV.3-Participatory Technology Development - a "New Research Paradigm"

Experience has shown that decrease in risks, and increase in production and sustainable productivity, is often possible through exploiting linkages and combinations of diverse elements in farming systems. In those processes farmers and their family members are natural experts. Martinussen (1997) argued that farmers generally act rationally in terms of their own situation and in terms of the way they perceive the options available to them. Schultz (1964) said that the farmers were 'poor but efficient', and they could most appropriately allocate their scarce resources and achieve the highest possible efficiency under the given technological conditions. Marketing, knowledge network, human resource development, and technological changes are the most important sources of growth for agriculture. Some researchers (Hayami & Ruttan, 1985) believed that, in some cases, technological changes would have greater impact if they were based on decentralized research, close to the farmers and with their involvement.

Since the earliest stages of agriculture, farmers have been active in developing technologies for the production, processing and storage of food. Farmers discovered, selected and domesticated all of the major food crops and animals. Through their innovative activities, many different farming systems emerged, adapted to the local conditions and available resources. Also at this moment, farmers are still playing a very important role in technology development (Haverkort B. *et al.*, 1991). Rhoades (1988) believes that there is evidence that farmer-initiated technological change does not occur by accident, but that there is a farmer-based method for research that, in many ways, is similar to the scientific method.

It is proposed that the role and functions of agricultural research and extension workers as well as the way they work together and work with the farmers is due for a re-assessment. In practice, there are quite a number of experiences, where extension workers, researchers have successfully worked together with farmers in the development of their technology (ILEIA, 1991; Bunders *et al.*, 1991; Scoones *et al.*, 1994; van Veldhuizen *et al.*, 1997). The necessity and opportunity to include farmers' knowledge and skills in improving complex agricultural problems are well documented in a wide range of overseas extension literature, at the theoretical and practical level. It is noted that farmers are already contributing to the research effort and that opportunities will be lost if researchers and extension-workers neglect to seek collaboration (Dunn *et al.*, 1996). The basic needs approach in technology development of the RRD is not primarily welfare, charity nor only productivity-oriented, but increasingly high and diverse farm income and strengthening the basis for long-term self-generating development. It is proposed that the research and extension program which involves the widest possible participation of the people whose needs are addressed, are most likely to be effective.

We have often heard that farmers are poor because they lack motivation and spirit of self-reliance; that they are individualistic especially when it come to economic activities or they are just waiting for government assistance to come and take it as granted. However, we also know that there are many successful stories of farmers who work together in undertaking common activities. Through group action, they are able to create a better life for themselves and for future generations. Various programs have been designed or are being designed to secure better participation of the rural poor in planning and implementation through *group action* (Umali, 1978).

An increasing number of publications support and document the argument that farmers have a wealth of knowledge on their own environment, have developed specific skills to use this environment, and are very active and creative in adapting the ways they use the environment for reaching their objectives. Pretty (1998) suggests that new policies must be enabling and creating the conditions for development based more on locally available resources and local skills and knowledge. He declares a series of national policies for facilitating sustainable agriculture, that seek to bring together a range of actors and institutions for creative interaction and joint learning. Farmers often know what is good for them and they represent a massive resource in terms of labor potential, practical knowledge, experience and ideas. Farmers' participation is necessary to narrow the gap between the farmers' goals and the government's aims and strategies (Hollnsteiner, 1977). The accumulated experience suggests that research and extension programs are likely to be more successful in the long run when officials, organizations and local people are involved in design, decision-making, implementation and evaluation activities.

The literature makes the distinction between "top-down" and "participatory" development and transfer of agricultural technology. Farmers have limited access to decision-making before a planned research and extension program is ready for implementation. If at all, they are only participating in the pre-planning stage, probably as respondents in an interview on their needs and problems. During program implementation, only community leaders have anything to say about the allocation of resources emanating from community programs. These "involvement" is not genuine participation (Castillo, 1983). Many authors in the field of technology and rural development have developed the participatory approach: Rhoades & Booth (1982) noted that research activities should begin and end with the farmer. This thinking was later developed into 'farmer-first' (Chambers, 1990), 'putting people first' (Cernea, 1991), 'farmer participatory research' (Farrington & Martin, 1987), 'farmer's research in practice' (van Veldhuizen *et al.*, 1997), etc.

The above discussion leads us to think about new approaches for research and extension work. As we saw in the past, the TOT model only works well under given conditions of farming systems where uniform practices and external inputs are available. In recent years, there is tendency to change

the extension approach in the direction of advisory work and of the facilitation of learning through the operation of IPM programs. These approaches are more participatory and facilitate learning processes of both farmers and organizations with the use of the AKIS perspective.

## V-Implications for the study on agricultural innovation and technology policy in the RRD

As mentioned in the previous chapters, in the RRD farmers are extremely small with limited possibility of land development. In the recent years, the price of rice as major staple tends to decrease while the productivity is "reaching the ceiling" as farmers said. Efforts to increase the productivity of this crop is seemingly not the best way to develop agriculture in the region. On the other hand, it is recognized that the farmers are innovative. They are hard working and have been creating many opportunities for improving their lives. In many cases, they present their needs in reaching a diversification of their incomes, capture markets and opportunities to take collective action (see following chapters).

The question of sustainability in agricultural development in the RRD is related to the participation of farmers and to the collective decisions of their community on research and extension practice. At the program level, participation is often characterized in terms of the point or stage at which client are involved in decision making, such as problem diagnosis, research and extension design, implementation, monitoring or evaluation. At the higher level of policy making, farmers participation may be characterized as an important source of information that is engaged to analyze aspects of policy and ensure that policy be more realistic and feasible in practice. The information from farmers is not only important for decision making by other farmers, but also for decisions on extension and research programs and government policies (Van den Ban, 1997).

Practically, a participatory approach is used in the AKIS approach in which local people perform a more active role in a research process that is supported to provide information for action (van Dusseldorp *et al.*, 1994). The active participation of related actors in important meetings helps extension workers and researchers to reformulate the problems in the research process, and raises their ability to improve methods or strategies of research and extension for solving those problems.

The first principle of the participatory approach applied in this study is the assumption that many farmers are actively engaged in an on-going search for new or improved technologies and livelihood options. Another principle is that there are elements within local farming systems and the larger contexts within which they exist, which have not been observed or examined by formal research and extension programs, but which are understood and are being explored by farmers themselves. The key assumption is that it is through an examination of these elements, an examination based on the

knowledge and understanding of farmers, researchers and development workers, that sustainable techniques and solutions can be developed.

## VI-Research Questions

In order to reach the objectives of this study, there are some key questions that need to be answered:

1) Is there a gap between the way farmers innovate and the way institutions make policy? If yes, what gap?
2) What kinds of knowledge and information from which actor are relevant to making decisions?
3) How and why do farmers and their communities react to government policies for technology development and extension to deal with problems of agricultural development in the RRD?

These questions have been translated into specific questions as followings:

a) How are policies for agricultural research and extension chosen? Why are these policies chosen in this way?
b) What policies do research and extension agencies use?
c) How and why do farmers behave regarding innovations promoted by the government program on technology development and extension?
d) How do farmers actively develop their (new) farming systems?
e) What do they think about innovation? How does 'the system' work?
f) Why are farmers trying to innovate in ways that are not in agreement with the concerns of the government?
g) What are differences in interests or needs between the government and farmers? Why?
h) How can the policy fit farmers' needs?

Before entering to the debate on issues relating to above mentioned problems and drawing conclusions that can satisfy the research objectives, the study needs to be equipped by methodologies that guide the analytical framework.

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# Chapter 4
# METHODOLOGY

The chapter describes the major methodology to collect and analyze the data that will be used to answer the hypotheses. In this chapter, the methods of qualitative case study and the analytical framework are presented.

## I-Abstract

The development of agriculture involves many things. Technologies that are more appropriate, supportive policies, different ethics, and changes in individual behavior are among the more obvious factors. One contributing factor that deserves more attention is the participation of the actors involved in the development process. The study on technology and extension policy will not focus on a specific farming strategy, but use a system-oriented approach to understanding complex ecological, social and environmental interactions in rural areas. All actors have uniquely different perspectives on what is a problem and what constitutes improvement. In a changing world, the resolution of one problem may lead to the production of another 'problem-situation' that leads to uncertainties of declaring an issue or a problem. Thus, it is essential to seek multiple perspectives on a problem situation by ensuring the wide involvement of different actors and groups. Participation and collaboration become essential components of any systems of inquiry, as any change can not be effected without the full involvement of all stakeholders and the adequate representation of their views and perspectives (Pretty, 1994).

The study on agricultural innovations and policies for technology development and extension in the RRD required many discussions with different related actors who are policy-makers, research and extension workers, farmers, etc. These discussions were based on field situations in various locations in the region where farmers are following their choices of farming and government officers are trying to operate research and extension programs. A case study methodology is used in this study in order to reflect the participation of the multiple stakeholders involved and their collaboration throughout the period of my fieldwork.

## II-Case studies

The exploratory character of the research and the intention to grasp different aspects of agricultural innovation and technology policies in the RRD motivated the choice for a case study research approach. Another reason for choosing a case study research approach is the flexibility (several case studies in my study were conducted simultaneously), and the diversity concerning the methods of research applied to them. The methodologies of human inquiry can be seen as disciplines, which can train the individual and develop the community towards a consciousness of future participation (Reason, 1994). Research with people is concerned with the transformation of organizations and communities towards greater effectiveness and greater justice. This approach requires valid knowledge about its strategy, knowledge of the behavioral choices, and knowledge of the outside world (Torbert, 1991).

The case study is an ideal methodology when a holistic and in-depth investigation is needed (Feagin *et al.*, 1991). Case studies have been used in different investigations, particularly in sociological studies. In the study of technology policy, case studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data.

Case studies are not selected on the basis of sampling; they are chosen by the researcher in the field. However, selecting cases must be done so as to maximize what can be learned in the period of time available for the study. The unit of analysis is a critical factor in the case study. It is typically a system of action rather than an individual or group of individuals. Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined. Case studies represent multi-perspective analysis. This means that the researcher considers not just the voice and perspective of the actors, but also of the relevant groups of actors and the interaction between them. This one aspect is a salient point in the characteristic that case studies possess (Tellis, 1997).

The issue of generalization has appeared in the literature with regularity. It is a frequent criticism of case study research that the results are not widely applicable in real life. Stake (1995) argued that case study can be used as an approach that centers on a more intuitive, empirically grounded generalization. He termed it "naturalistic" generalization. His argument was based on the harmonious relationship between the reader's experiences and the case study itself. He expected that the data generated by case studies would often resonate experientially with a broad cross section of readers, thereby facilitating a greater understanding of the phenomenon.

My study used multiple sources of evidence: non-formal interview instruments, interviews, and documents. Most case studies are qualitative. One of my case studies uses a mix of qualitative and quantitative data. All else being equal, numbers do offer advantages. In field settings, though, one often has to make other sacrifices to be able to use them. Most importantly, sometimes

numbers are not easily applied to some features of the study on policy theories. It is difficult to apply survey methods to generate quantitative data in a study that seeks to assemble a "rich picture" on the basis of interviews of very different informants and respondents. In addition, developing a suitable quantitative measure is often difficult and time-consuming. It may be more time-efficient to use qualitative data. It is easier to be flexible and responsive to the situation if using qualitative methods. Differences between data sources used critically can then lead the researchers and the participants towards a deeper and more accurate understanding.

The case study is a methodology whose flexibility stimulates the researcher in learning and responsiveness. Vague beginnings can move towards better understanding and practical improvement through the critical analysis of the information, the interpretation of it, and the methods used. The conclusions draw on databases, preferably data from multiple sources. The conclusions emerge slowly over the course of the study.

## III-Design the case study

Yin (1994) suggested that researchers of the case study must possess or acquire the following skills: the ability to ask good questions and to interpret the responses, to be a good listener, be adaptive and flexible so as to react to various situations, have a firm grasp of issues being studied, and unbiased by preconceived notions. The case study research approach used in this study includes:

- An overview of the case. This includes objectives of the whole study, case study issues, and presentations about the topic under study. It helps keep me focus on the main tasks and goals while the process of development brings out problems that would only be faced during the actual situation of the study.
- Field procedures for access to data sources, location of those sources.
- Case study questions that I must keep in mind during data collection. Each question also has a list of probable sources.
- A guide for the case study report: the outline and format for the report. However, in my view, case studies do not have a widely accepted reporting format. The reason for the absence of fixed reporting format is that each case study is unique. The data collection, research questions and indeed the unit of analysis cannot be placed into a fixed mold as in experimental research. Hence, the experience of the researcher is a key factor.

The research questions framed as "who", "what", "how", and "why" determine the relevant strategy to be used in my case study. The unit of analysis in a case study could be an individual, a community, an organization, etc. (Sjoberg *et al.*, 1991). In my study, the unit of analysis is understood

as a community of people who involved in the process of technology development and extension in the RRD.

The role of agricultural research and extension is to help farmers solve the problems that confront them. Problem solving with farmers requires a high degree of technical expertise, but it demands even greater understanding of the social process of farmer innovation and implementation. A participatory approach to research and extension can also provide deep insights into farmers' resource constraints and opportunities, and help identify strategies for enabling them to find sustainable solutions. In this implication, participatory research and extension methodologies, along with attention to new technologies, could be key elements of those "farmer-first" research and extension policies.

The methodology of case study has been applied in the study on technology development and extension in the RRD. During the time of my fieldwork, farmers and other related actors were actively involved in the discussion about the process of agricultural innovation and decision making in the region.

### IV-Conduct the case studies

Generally, the case study that attempts to organize the data around the unit of growth, or individual life pattern does force the researcher to think in these terms rather than fall back on trait analysis alone. As a working definition we may characterize a case study as a detailed examination of an event (or series of related events) which researchers believe to exhibit the operation of some identified general theoretical principle. The extent to which generalization may be made from case studies depends upon the adequacy of the underlying theory and the whole corpus of related knowledge of which the case is analyzed rather than on the particular instance itself (Mitchell, 1983).

Yin (1994) identified six primary sources of evidence for case study research. The use of each of these might require different skills from the researcher. Not all sources are essential in every case study, but the importance of multiple sources of data to the reliability of the study is well established (Stake, 1995, Yin, 1994). The six sources of information identified by Yin (1994) are: documentation, archival records, interviews, direct observation, participant observation and physical artifacts. In my study, the first four sources were applied. Documents in my case studies include study reports from research institutions, project documents and annual reports from administrative schemes of ministry of agriculture and rural development, and records from communes, districts and provinces where I conducted my fieldwork. The validity of the documents was carefully reviewed so as to avoid incorrect data from being included in the database. One of the most important uses of documents is to corroborate evidence gathered from other sources. Archival records are also useful in my study since they include service records, maps, charts, and survey data.

Interviews are one of the most important sources of my case study information. Semi-structured interviews with key informants and group interviews were used to generate and organize relevant information. The interview with a total of eighty farmers, across the case studies with respect to innovation in the region, was conducted to obtain additional information. Information between sources has been carefully cross-checked systematically. The regular feedback to those interviewed was made to enrich the analysis with their observations and comments. End results have been presented to those involved for a final check on detail and a chance to comment upon and discuss the interpretation of the ideas and events studied. The case studies explore ways of strengthening the responsiveness of agricultural research and extension (through examining policy-making process) towards the problems and opportunities of farmers.

There are so many exciting evidences of the farmers' innovation in terms of changing the way of farming, value adding activities, etc., happening in the region. In my point of view, with respect to the process of the technology development and farmers' innovation, the selection of four cases on changing land use systems, promoting winter crop production (the use of TPS[23]), IPM, and government policy setting for research and extension in the RRD are typical examples. Each case looks at different aspects of the farmers' innovation process and official innovation theories and efforts, but they are incorporated into diagnosing the problem identified and suggesting possible policy theories and procedures for supporting farmers' innovation. Because of different aspects to be argued, each case was written as a separate chapter with a section presenting methods used in detail.

A sample of 40 farmers from the communal list of Thanh Xa (Nam Thanh district) was randomly chosen by using systematic sampling methods for interviewing issues that mainly related to changing land-use. The sample of 25 farmers in different districts of Dong Hung (Thai Binh province), Y Yen (Nam Dinh), Binh Luc (Ha Nam), Thuong Tin (Ha Tay), Chau Giang (Hung Yen), and Nam Thanh (Hai Duong) was non-randomly selected for interviewing issues relating to winter crop production. Another non-random sample of 15 farmers was also chosen for interviewing issues of the IPM program. However, during the interview, every individual of the eighty selected farmers was also asked to discuss various related issues. For example, the forty interviewed farmers in Thanh Xa also discussed winter crop production, the IPM program, their opinions on technology policies, and so on. The interview has been conducted to understand the real conditions of farmers in the region, their opinions on innovation and what they are expecting from the government policy. This information does complement the information from the four case studies to examine what is going on in farmer fields and to explain why the farmer try to improve their livelihood in a different ways with help of

[23] TPS: True Potato Seed

extension. The main information from the interviews are presented early (Chapter 5) as the initiation of my inquiry to explore different aspects of problems existing in the field.

The four case studies were designed as followings:

***Case 1**: Changing land use systems in rice-based field in Nam Thanh district, Hai Duong province.* Looking at the situation in the RRD, the effective management of natural resources is receiving much more attention by both farmers and the government. This can be seen as a typical case on natural resource management in the RRD. As indicated in the previous chapters, the limitation of land, the high productivity of the rice crop together with the decreasing price, etc., has forced farmers to look for alternatives of their farming system. In the last decade, farmers in Nam Thanh district were very active in adapting new technologies to the local conditions and in seeking new ways of farming. The case study was chosen to understand the difficulties farmers in the district have in dealing with problems of scarce-resource management and their efforts to overcome these difficulties. The need to make optimal use of available resources confronts these farmers with new challenges of the development process. What should technology development do to support the livelihoods of resource-poor farmers? What are opportunity costs in the region? What are conflicts in the choice between the development of a new farming system and other opportunities in winter season? And so on. That seems to be the near future of agricultural development in the RRD when slow development of industries and services continues to fail to absorb redundant labor force from agriculture. The case asks for a good direction or approach to reach sustainability of agricultural development in which, as my point of view, research and extension policies will play an important role. A total of forty farmers was randomly chosen for interview about those issues (see Chapter 6).

***Case 2**: New technologies and the choice of farmers - the case of true potato seed (TPS) production in the RRD.* Under conditions of limited land for cultivation as in the RRD, the expansion of winter crop production is seen as one of the strategies for increasing farmers' incomes. The selection of what kind of crop is to be planted and what kind of technology is to be applied in the winter season are major concerns of the farmer. Many efforts have been made to improve the cropping pattern in the region (Chapter 2), but the results are very limited. In the recent years, winter crops are often seen as cash crops. Sweet potato, maize, soybean and many other crops have been introduced to farmers for planting as third crop in the rice-based field. In many cases, they did not indicate advantages in terms of money income, good cropping pattern, or productivity. The development of TPS technology is seen as one of the potential solutions for improving farmers' income in the region. That is why the government is now trying to operate quite a big program on the development and expansion of TPS-based production in the RRD. However, many difficulties are hampering a wide adoption of the technology. The case describes the existing situation and reactions of different groups of farmers to the

recommendation of using botanic hybrid seeds instead of traditional tubers in the potato production. One of major problems of traditional potato production is the high cost of tubers that results from the loss in a long-time storing period and from disease attack. Many research efforts to improve methods of seed selection and planting practice have been made, but expansion of the results is still limited. The recommendation of TPS-based production gives farmers a chance to get more benefits than the traditional one, but the adoption rate is not as expected by the program. Some farmers have success; others express their reluctance to adopt it. It is expected that if the process of TPS adoption is done well, more research funds will be available from the government to develop better potato seeds, replacing the old inefficient methods. What are problems of research and extension? Should priority be given to develop true potato production in the RRD? Why do farmers' reactions differ from place to place? etc. (see Chapter 7).

***Case 3:*** *The IPM program in the RRD.* The case has been selected because the IPM Farmer Field School has been seen as one of the extension methods that is applied in the region. Although IPM programs on irrigated-rice fields have been introduced since the early 1990's, the results are still a question. The operation of the IPM program reflects government efforts in improving farmers' knowledge and practices only in rice production, but the farmers are cultivating many different kinds of crops. The case describes the applicability of IPM in the RRD and how the program operates for crops other than rice. Growing winter crops (maize, potato, soybean, vegetables, etc.) requires that more inputs are applied, particular chemical inputs, and that the farmer needs to know about the cultivation of these crops and how to protect them. The expansion of winter crop production raises new issues for the sustainability of agriculture in the RRD. In addition, changing to the new farming system (e.g., raised bed systems for VAC[24] model) also increases new demand for extension support with respect to planting and protecting fruit trees. In recent years, the government has tried to operate an IPM program on potato production in the region. However, this effort seems to be facing many difficulties and problems of potato production itself, such as different perceptions of farmers in choosing conventional or new seeds, the available markets for potato seeds and products, etc., and other choices of cropping patterns. The case also indicates farmers' interest in the IPM approach, and whether IPM is applicable to winter crop production and other farming systems (see Chapter 8).

***Case 4****: Agricultural research and extension program and farmers' opinions, the case of RRD.* The case reviews how government policies are applied in the region through the operation of research and extension programs/projects. In this case, together with reviewing project documents, information was gathered by interviewing government officials (officers working at the ministry), researchers, provincial and district extension workers and farmers. Looking at the process of preparing an

[24] VAC: a Vietnamese farming model means Garden (V), Pond (A) and Cattle Shed (C)

agricultural research and extension master plan at different levels (ministries, research and extension organizations), the case tries to clarify official innovation theories and efforts and identify possible way to improve the process more effectively (see Chapter 9).

As mentioned above, this study attempts to examine the relations between *agricultural research & extension policy* and *farmers*. The study identifies the roles that information from research, extension and farmers play in the process of formulating research and extension policies. This study explores and discusses ways of strengthening the responsiveness of agricultural research and extension policy towards the problems and opportunities of farmers, and sustainability in agricultural development in the region. The study tries to make an examination of the information flow for research and extension between farmers and policy-makers.

During the course of my fieldwork, individual interviews with researchers, extension workers, farmers, and policy-makers were conducted that use a general interview guide approach. The individual interviews with farmers do not only focus on the contributions of agricultural research and extension, but concentrate on farmers' decision making with respect to issues of new farming systems, winter crop production, their reaction to the IPM program, and on proposed other ways of farming.

### V-Analysis of case studies

The "data analysis consists of examining, categorizing, tabulating or otherwise recombining the evidence to address the initial propositions of a study" (Yin, 1994). The analysis of the case study is one of the least developed aspects of the case study methodology. The researcher needs to rely on experiences and the literature to present the evidence in various ways, using various interpretations. This becomes necessary because statistical analysis is not necessarily used in all case studies (Tellis, 1997). In my study, I have tried to make sense of the sense making of others. What is important is how the world is seen by different stakeholders, not how the world is. Their beliefs, values, interpretations and actions are the "active ingredient" that makes things happen in technology policy. The analysis can suggest ways in which I can make recommendations that may be important for making policies that reflect and are responsive to the interests of the farmers in the region.

As mentioned, this study does not strongly examine problems of the content of specific strategies or policies, such as extent and level of expected technologies should be translated into research and extension programs, the allocation of resources or the impact and efficiency of these programs. The emphasis here is on research that will deal with the purpose/reason for public sector research and extension as technology development programs/projects, the approaches or methods of using available knowledge to choose strategies and formulate policies, and the ways of communication in the process of policy making and implementation. The analysis also made a review of policy-

making about agricultural research and extension in the region, as a learning process that has experienced successes or weaknesses in the last decade.

This study attempts an analysis of some important aspects of:

1) Policy theory: Make explicit that the conventional policy model (Röling, 1997) is based on three mutually supporting and interlocking theoretical perspectives: "*agricultural treadmill*" (Cochrane, 1958), the *diffusion of innovations* (e.g., Rogers, 1995), and the linear model of *technology transfer*. The question is: how do Vietnamese organizations think about these perspectives when making decisions on research and extension programs/projects to deal with the problem of farmers in the RRD? For which problems are these suitable perspectives, for which not? In this study, four descriptive case studies are conducted to increase our understanding of the ideas of different stakeholders on what perspective should the policy for technology development and transfer in the RRD be based.
2) Trade-off between levels of the properties of agro-ecosystem: *productivity, equity, stability and sustainability*. Conway (1994) presented his ideas on Agro-Ecosystem Analysis (AEA) which provides a theoretical and practical context for useful definitions of productivity, stability, sustainability, and equitability. The ideas are applicable in examining how trade-off between levels of the properties is seen by policy-makers at different levels of the research and extension management in the RRD. What is different between farmers' needs and government objectives? How do they address problems in the policy-making process for research and extension? How can they be translated into research and extension policy? What are criteria for setting priorities for technology development and extension in the RRD, and why?
3) The formulation of policy: The *communication* between stakeholders in the process of policy-making. Looking back to the conventional framework for making policies for research and extension in the past, this study examines information flows on which policy-makers base the formulation of their policies, and also how farmers communicate with government agencies.
4) *Farmers' reactions* to agricultural research and extension programs: farmers' assessments of technologies and policy for research and extension are examined by the results from the interview of farmers.

The matrix for the analytical framework is presented as in Figure 4 below. Some socio-economic indicators to be taken into account during analysis are presented in Table 6.

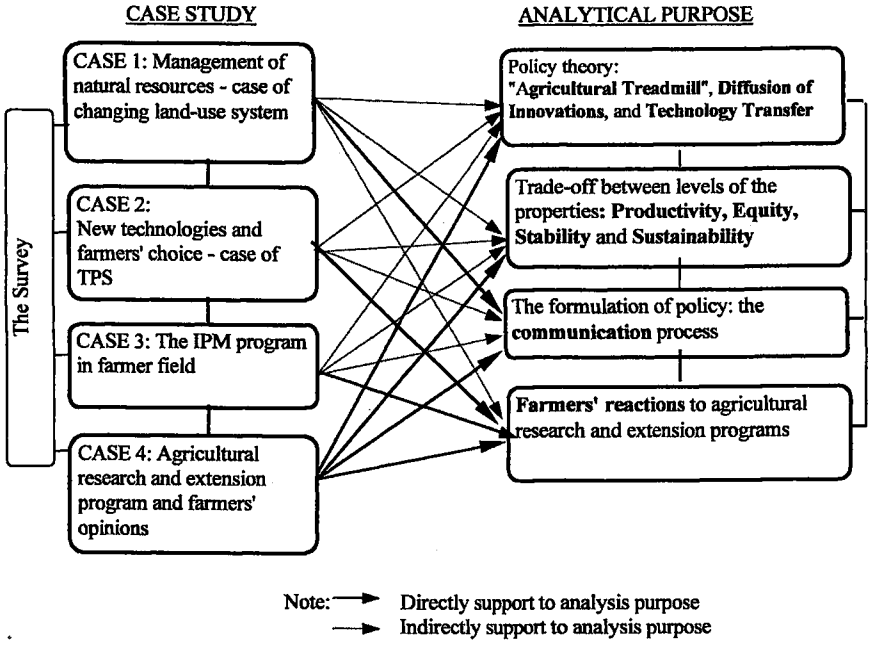


**Figure 4 - Summary of relations of cases and analytical purposes**

**Table 6 - Some socio-economic indicators to be taken into account during analysis**

| Agro-ecosystems and policy environment in the RRD | Production systems | Farming issues | Concerned indicators |
|---|---|---|---|
| • Irrigated land with small farms and many plots.<br>• New policies on economic reforms | • Rice-based farming (with three crops in the year in some areas)<br>• Cash crops<br>• Animals<br>• Aquaculture<br>• Horticulture<br>• Mixed | • Adjusting to increase productivity of competitors<br>• Irrigation management.<br>• Lack of market development, especially for winter crop production (potato, vegetables, etc.)<br>• Limited technology choice<br>• Population pressure | • Food production<br>• Family incomes (cash income)<br>• Poverty<br>• Access to flooding-land<br>• (Old and new) cropping patterns<br>• Adoption of new technologies<br>• Weeds, pests & diseases<br>• Excessive use of agrochemical<br>• On-farm water management<br>• Surplus labor<br>• Non-farm activities<br>• Market price |

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# Chapter 5
# A JOURNEY TO THE FARMS

This chapter presents briefly information from the interview with eighty farmers in different locations of the RRD. The chapter describes farmers' opinions regarding such issues as their incomes, innovation, crop protection, sustainability of new farming systems, and the research and extension work in the region. From this information, the reader can gain an impression of situations in the field in order to get a better understanding of the research objective and hypotheses presented in previous chapters.

## I-Abstract

The interview has been conducted during the time of my fieldwork in Vietnam (1998-2000). A total of eighty farmers in six different districts of the RRD were interviewed with a semi-structured questionnaire (see annex at the end). The interview aims to collect additional information for analysis of the case studies. The interview started in 1998 and continued in 1999 and was completed in the first half of 2000. In this chapter, I do not want to repeat farmer opinions that are presented in the chapters on the case studies. What is recorded in this chapter is complementary to the other chapters.

Arable land in the region is understood to include areas allocated to families, excluding the home gardens of the farmer households. Some parts of arable land may be registered as so-called "flooding-land"[25]. From Table 7, we can see that rice production is the most important source of farmers' income in Y Yen and Binh Luc districts, which have much "flooding-land". In other districts, farmers have more diverse sources of income from winter crop production, fruit tree planting, fish raising, and so on. One of the most important new aspects of lives of interviewed farmers is that they do not face problems of food insecurity anymore. Most of them are selling surplus rice to pay for the cash expenditures of their family. In Nam Thanh, farmers sell a smaller part of rice because rice fields are reduced as a result of the changing land-use process. The farmers complained of the low price of their products in the market, especially the price of rice.

[25] Areas that are inside the controlled irrigation system, but that likely flooded throughout the year as wetland. The farmer can only grow rice in those areas because of physical circumstances.

**Table 7 - Profile of interviewed farmers in 1999 in different districts of the RDD, Vietnam (averages)**

| | | Dong Hung n = 10 | Y Yen n = 10 | Binh Luc n = 10 | Thuong Tin n = 5 | Chau Giang n = 5 | Nam Thanh n = 40 |
|---|---|---|---|---|---|---|---|
| * | Farmer Age (years) | 45.3 | 47.0 | 49.5 | 42.2 | 48.6 | 50.8 |
| * | Number of family members (persons) | 5.6 | 6.0 | 6.5 | 5.4 | 5.2 | 5.1 |
| * | Education (years of school) | 8.8 | 7.5 | 7.2 | 8.0 | 8.5 | 7.7 |
| * | Arable land (sq.-m/hh[1]) | 2,240 | 3,600 | 3,900 | 2,700 | 2,080 | 2,550 |
| * | Rice field (% of arable land) | 95.0 | 100.0 | 100.0 | 86.2 | 78.4 | 62.3 |
| * | Area registered as flooding-land (% of arable land) | 18.0 | 35.6 | 32.7 | 15.6 | 15.0 | 28.0 |
| * | Area of changed land-use systems (% of flooding-land) | 0.0 | 0.0 | 0.0 | 0.0 | 85.0 | 96.1 |
| * | Area of winter crop (% of land) | 34.5 | 15.0 | 10.0 | 38.2 | 41.0 | 30.1 |
| * | Area of winter potato (sq.-m/hh[1]) | 750 | 200 | 100 | 1,026 | 380 | 250 |
| * | Area of fishpond (sq.-m/hh[1]) | 108 | 210 | 150 | 88 | 120 | 166 |
| * | Area of home garden (sq.-m/hh[1]) | 166 | 258 | 158 | 317 | 269 | 211 |
| * | Income from rice (% of total income[2]) | 58.4 | 71.5 | 77.7 | 62.5 | 42.2 | 28.3 |
| * | Income from winter crops (% of total income[2]) | 24.3 | 12.6 | 8.6 | 21.6 | 25.5 | 16.6 |
| * | Income from home garden (% of total income[2]) | 2.0 | 1.5 | 1.0 | 2.0 | 3.0 | 4.0 |
| * | Income from new farming systems (% of total income[2]) | 0 | 0 | 0 | 0 | 12.0 | 35.0 |
| * | Income from potato (% of total income[2]) | 22.9 | 5.0 | 2.9 | 20.0 | 11.0 | 3.8 |
| * | Problem of food insecurity (not enough rice to eat) | *No* | *No* | *No* | *No* | *No* | *No* |
| * | IPM program in rice (attendance) | 1 | 1 | 0 | 0 | 0 | 3 |
| * | Selling rice (% of rice production) | 30.5 | 42.0 | 20.2 | 30.4 | 15.0 | 5.6 |
| * | Selling potato (% of potato production) | 71.0 | 60.2 | 50.0 | 75.0 | 48.5 | 40.3 |
| * | Main market problem | low price | low price | low price | low price | low price | low price |

[1]hh = household; [2] Value incomes.

There are many more details on what I observed and learnt from the farmers whom I visited. For about eighty records, it is not easy to classify and make categories of information. Many things have been changing in the farming communities. Each interviewed farmer has a different and diverse combination of farming and non-farm activities, of which many are changing from time to time (for instance, farmers change their cropping patterns to respond to market demands, especially in the winter season). During the period of my journeys, information from previous visits was always enriched by new ideas and/or new farming activities undertaken by the farmer's family members. The reason for qualitative analyses in this study is that provinces are very different and not comparable. I wanted to get a good impression of the range of conditions, but I could not do many surveys in each district. In addition, the number of interviews in each district, except in Nam Thanh, is too small for statistical analyses. I came up with issues of what I wanted to analyze and address in the study. For each issue, the opinions of the case study farmers present in this chapter have been integrated or combined with ideas of other farmers whose opinions were more or less the same. For reasons of privacy the name of interviewees is noted as the surname. I

prefer to present the interviews as "*A Journey to the Farms*" with four stops regarding the issues of TPS, the IPM program, the gardening model and technology development and extension. I will conclude with policy implications.

## II-We need more cash crops

**Picture 2: Potatoes inter-cropped with vegetables**

Following directions on the map, I come along a small, but quite good road to Trong Quan commune (see the map in Figure 3 - Chapter 2). Alongside the road, rice fields were green with winter potato inter-cropped with vegetables. Some farmers are working in their small field. The commune with scattered villages is located in Dong Hung district of Thai Binh province near the Red River. This is a very flat area in the eastern part of the RRD with some land outside the dyke.

It takes about twenty minutes by motorbike from the provincial capital to get the commune. As in many other communes in the RRD, there is one densely populated commune with more than 7,200 people of 1,300 families living in three villages.

I turned to the right and stopped at a first small hamlet[26], namely No.1. The village lies nearby the commune center with about 44 families living there. The first time when I came here, I was attracted by the good transportation network of the commune and also of the village, with small roads built of cement or/and bricks (I was told that the rural transportation network in almost all communes of Thai Binh is good). Not only commune or village roads are improved, the family gate is also in a good condition. I understood that the villagers themselves have built all of the commune road and gates without any support from outside. I realized that many houses in the hamlet have just been repaired or newly built, although they are still keeping the traditional model of rural housing with the kitchen separated by a small yard made of cement or bricks. Some families have a small pond and most of them have a well for the family's use. From the fringe of the hamlet, I can see many individual TV antennas and the electricity spanning the area.

I stopped of the small house of Mr. Tran, a man of forty-five years old. The family has seven members including his wife and five children, two sons and three daughters. The children are

[26] In the RRD, the commune consists of villages and a village may be divided into hamlets.

going to school and one of them is studying at high school in the district town. After introducing myself, I started talking to Mr. Tran about the family's farming.

His farm is of eight *sao*[27] arable land divided into three plots in different areas of the village. Almost all his land (90%) has fertile soil, is irrigated and supports two rice crops in the year. About two third of the family's land can be used for winter crops, as the third crop in the year. During the discussion, I found that he is an experienced farmer with good production skills. He often gets an average of rice yield of 250kg/*sao*/crop-season (or about 6,750kg/ha) meaning that a total of four tons of rice are produced in the year. He was one of the first farmers of the commune to apply true potato seeds in the winter season to replace traditional tuber-seeds in 1994. In the last year (1999) he got about 3 tons of potato from four *sao* (yielding about 22 tons/ha) of land in the winter crop season. His family is also raising some pigs each year and fish in the small family pond.

In his counting, half of the rice production is used for home consumption as food for his family members, feeding four pigs and chickens (the chickens are used for home consumption only). Another part of paddy is for selling in the local market. Almost all potatoes (70%) were sold after the harvest or stored for selling tuber-seeds in the next season to other farmers, the rest was used mostly for feeding pigs. According to him, for many families in the commune, income from farming can cover all of the family's costs of production, school fees, health care, food, etc., and a little surplus for buying furniture, such as TV, radio, and so on. In the commune, nobody has got income from activities, other than farming. There are only few small shops selling things to local people. However, he said that his children are growing up and they need more money for their study and his house is seemingly becoming smaller as his children grow-up. For the near future, he said his family will need to repair the house, or build a new one.

He guided me to see his field on which one plot can grow three crops (including winter crop) and another two rice crops in the year. He said that, the crop yield is now nearly "reaching a ceiling" that is very difficult to increase the yield of rice and also potato. Thank God, the rice yield was quite stable during last five years. During last year, the price of rice and potato was not so good (the paddy price is also going down in this year). He thinks that, by continuing the same way, his family could not get more income than before. He worries about his farming along the present cropping pattern from which may not be able to sustain the income of his family because of the low price of paddy and potato in the market. He realized that these prices decrease partly because other farmers succeed in increasing their crop productivity per hectare.

[27] In the RRD, *sao* = 360 sq.-m. In the central regions, *sao* = 500 sq.-m.

In order to improve the family's income, he started making a true potato seed (TPS) nursery in the winter 1998 in the small plot of 200-sq. meter nearby his house. The seedlings were partly used for transplanting into area of four *sao* of his land and the rest for selling to other villagers. By doing so, he has got some extra income, equivalent to an area of two *sao* of potato production.

Talking about the role of extension in the commune, he said that the villagers could easily get updated information on new technologies such as new varieties, new kinds of fertilizer and insecticide, new production techniques, and also on market prices. This information can be obtained from the public communication network and/or from other farmers in the commune. At present, he does not think the farmers in his village need help from extension for rice crop production. Farmers in the village now can produce enough rice for the family's consumption without facing cultivation problems. However, in his opinion, they need more assistance from extension on providing them training and information on other crops than rice. They are willing to pay for this kind of extension services. The villager's request was reported and discussed at commune meetings and submitted to the Provincial Extension Center a few years ago. In reply to the farmers' request, extension service presented the action plan it had designed and the farmers were told they must follow it. Most of the extension activities were based on the consideration of food security and hence the need to promote food crop production at the expense of cash crops. Very few training courses on other topics have been organized in the commune. In fact, the farmer understood that the extension organization does not have enough resources in terms of time, staff members, finance, etc., to carry out some kind of 'extra-activities' as requested by a large number of farmers.

For a long time, Mr. Tran family and other farmers in the village have planted potato. The potato is sometimes used to make some kind of soup or fried as family food, but they said that is not very often and not their habit. Although local extension has played an important role in the introduction of winter TPS-based potato that has been seen as cash crop in the area, the market for this product has gradually become less favorable because of increasing production. In the meantime, many farmers in the commune can be considered as experienced potato producers in the winter season.

Before left Mr. Tran's household, some of his neighbors come to join our discussion. This is very common event in rural areas when a visitor comes to discuss farming. They recognized and shared most of opinions of what Mr. Tran said about their situation. In the last years, some farmers in the village tried to plant vegetables, watermelon, cucumber, etc., but these were a failure because of low yield and poor market. They need some improvement in their existing cropping patterns, so

as to plant more cash crops. Changing the land-use system as in some areas of Hai Duong and Hung Yen provinces is not encouraged by local authorities who are trying to execute the food security policy. In addition, these farmers are not very familiar with other cash crops, both in terms of production practices and marketing.

Saying goodbye, I wondered why the people in the village have different needs from government and why there are so few interventions of the state to assist them. I will never forget what they said: "We need more cash crops than food crops for our future." I have the impression that farmers in the village are very dynamic in creating opportunities for improving their livelihoods and believe that they can overcome problems and improve their situations.

## III-We want better crop protection

**Picture 3: Land preparation for winter crop production**

The second stop of my journey was in Yen Phu commune (see the map in Figure 3, in Chapter 2). The commune now belongs to Nam Dinh province, at 100 km distance from Hanoi. When I first came, people were busy with their winter crop production. Many people were working in the field. I thought that I might have come at the wrong time.

Entering the Yen Hoa village, I was lucky to meet a woman returning home after finishing her fieldwork. Mrs. Hoang was about fifty years old and a sympathetic woman. After greeting and having a talk with her, she invited me to visit her house.

There is quite big family with nine members including her mother-in-law, her husband and six children. In my view, the family is quite poor compared to Mr. Tran's in Trong Quan commune. Her husband was a man of fifty-five years old. When I came, he was repairing a sprayer in the back yard. I had some discussion with him while he was working and his wife collected water for growing a few beds of vegetables in their home garden. So, I could be at ease to discuss with them.

Their commune has the smallest area of the district. In the past, only one rice crop was grown in spring season because of flooding in the summer. Since 1960s, the construction of the irrigation system in the district and in the commune has provided the condition for farmers to plant two rice crops in the year. Together with improvement of the irrigation network, farmers' experience in rice production and the introduction of high yielding varieties have contributed to an

increasing crop yield. Most families in the commune have overcome problems of food shortage and they are looking for an improvement of their income. After the introduction of new economic policies in 1988, farmers in the commune started planting winter crops as a third crop in the year.

The average yield of the rice crop in the village (and also in the commune) is not so high with 4.5 to 5 tons of rice per hectare in each crop season, although many new technologies have been applied. According to them, damages in the rice crops often occur as a result of brown plant hoppers, leaf folders, rice blast, etc. In recent years, the "government" (as farmer said) had operated an IPM program on the rice crop in the village[28]. The women were encouraged to participate in this program during a period of sixteen weeks (a half-day per week) throughout the rice crop season. Mrs. Hoang was one of IPM members who participated in the program in spring 1996. She said that she was taught in very great detail what she already knew. According to her, the program is more applicable to young farmers, but sometimes it is boring for participants like her. Another issue of the program is that most of participants are women when men often undertake crop protection activities because it is heavy and dangerous work. No more activities of the IPM program have been implemented in the village after that season although, in her opinion, many farmers in her village need to learn this methodology. She was invited as one of twenty experienced farmers to participate as member of an IPM club organized by the commune leader in early 1997, with supervision of a local extension worker. The club was established in the commune in order to encourage local experienced farmers to participate in the IPM program to continue activities through a farmer-to-farmer learning process. All club members will meet monthly to discuss issues of the program and assign responsibility of each member and plan to conduct farmer-to-farmer FFS. However, since 1997 only two meetings of the club were organized and, in her opinion, the club's objectives and members' responsibilities were not very clear without any support and incentive.

The husband said that farmers in his village now could manage rice crop production with few pesticides by using them in a right time. Pest and disease attacks are not a serious problem for them anymore in their rice crop production. They can seek assistance from the communication network for any problem when a new variety is introduced or new types of pests and/or diseases occur. According to them, problems of rice crop production are mainly due to low soil fertility. The main problems of crop protection arise in growing other crops than rice.

The family has fifteen *sao* of arable land (about 5,400 sq.-m) with only 1,000 sq.-m that can be used for planting winter crops. As in the case with other families in the village, they have

[28] The Provincial Department of Plant Protection has implemented the IPM program in this area

planted many kinds of crops in the winter such as potato, vegetables, etc., as cash crops, but the return is often low as a result of pest and disease attacks.

It is difficult to treat vegetables with insecticides and that may be dangerous for users and producers, because many people are growing vegetables in their home gardens close to their houses. In many cases, their crops failed because of poor knowledge about crop production and pest management. They heard that IPM program on vegetables is operating somewhere, but they could not come to see the example because it is far away from their place[29]. The messages, which they received from their informal communication network and recommendations from the local extension agent, are inapplicable. Sometimes, they found it is difficult to understand what the messages said.

During last year (1999), the local extension worker came and informed them that their extension service is going to provide villagers more IPM activities on rice production, to allow farmers to continue on offer the previous operation in the province. He explained that the program has been designed as a part of food security policy in the area that his agency must follow, and that his agency does not have funds and experience to operate IPM activities that can be applied to other crops. There were only 17 farmers who participated in the IPM activity, which was a quite low rate because 25 participants were expected.

In the household of Mrs. Hoang, the cost of pesticides used in growing winter crops counted per unit of area is often 8-10 times higher than those used for the rice crop. They showed me a series of bottles of different kinds of pesticides on the shelf and they know well how to use them. However, the result is not as good as expected. "We don't know what types of pest and disease are attacking our crops and how to treat them. We want our crops protected!"

According to them, almost all farmers in the commune are facing this problem of winter crop protection. They have been trying to identify the solution, but they could not. They are unable to apply their knowledge of pest control in rice production to resolve problems in other crops.

I learnt that the objective of extension does not always fit the farmers' needs. The farmer needs to plant cash crops while extension program is interested in promoting food crop production. In this case, the extension messages were not easy to understand by farmers.

### IV-I am not sure how long I can make a profit

Thanh Xa commune is situated in eastern Nam Thanh district, Hai Duong province (see the map in Figure 3). For a long time, together with rice farming, the farmers in the commune have

[29] An IPM program on vegetable production is conducted by the National Institute for Plant Protection (NIPP) in the suburbs of Hanoi, and Hai Phong, Hai Duong and Hung Yen provinces. A Danish NGO is assisting farmers through the Farmers' Union, a People's organization, with IPM in beans and cabbage.

been very familiar with fruit tree production. Many families in the commune are now getting income from four main sources fruit tree planting, rice production, fish raising and winter crop production (see also Chapter 6). Litchi is very common in the farmers' home gardens. Many people see Thanh Xa as one of the good examples of implementing the VAC model[30].

**Picture 4: Harvesting litchi in Thanh Xa commune**

The visitor will easily see many new litchi trees planted in the rice field. According to information obtained from the district, farmers in this commune have changed their land-use system since 1991, and 78.39 ha[31] of "flooding-land" that used to grow one or two rice crops, now have been planted with fruit-trees. In the first three years, the trees can grow well together with a rice crop in the open areas. When the litchi mostly covers the field, the farmer will stop growing rice. The average income of the farmer in this area is higher than that of many other areas in the RRD (except for farmers living nearby cities).

When I came, it was the harvesting time of litchi. The household I came to visit is a family with four members. The man named Pham and his spouse Nguyen were harvesting litchi together with two children. The harvest time of litchi only covers two weeks. A stranger did not surprise them because many outsiders come there to sell things and buy the fruits or other farming products. Sitting in the shadow of a litchi tree, I was kindly invited to join them in eating the fruit and discuss litchi and other topics of farming in the area.

The family has thirteen *sao* (4,680 sq.-m) of land of which only about four *sao* can be used to cultivate two rice crops in the year with high yielding varieties. The rest, called "flooding-land", was used to raise fish or only spring rice with a low yield. In the past, the family faced a serious problem of food shortage during the last three months of the year. The family was one of first families in the commune who made a raised bed system in their "flooding-land" for planting litchi and banana or vegetables, and for raising fish in the pond since 1991. It was difficult time for them, they said, because it required considerable investment, and changes of rice fields into other land-use were not allowed at that time. The changed land-use system gave double returns in that area in the first three years, and about ten times higher in 1997 and afterwards. The problem of food shortage of his family has been resolved since 1994 as a result of the three-year attempt to develop the new way of farming. Their neighbors quickly realized the achieved result, and come to see their

[30] A Vietnamese farming model means Garden (V), Pond (A) and Cattle Shed (C)
[31] Communal records, 1999

new land-use system as good model for a new farming system. Many others followed the model. According to the farmers, realization of the effects of the new model of farming on farmers' incomes made the provincial authority give permission for changing the land-use system in 1997 as a pilot project applying to a restricted area of the commune.

As can be seen in the case of the new farming system, farmers usually reserve necessary areas of land under the best conditions of soil fertility and irrigation for rice cultivation. In the case of the household of Mr. Pham, four *sao* of fertile land provided them two tons of (paddy) rice. According to them, that is more than enough for the family's use.

I realized that the family has quite good living conditions with a good quality of housing, color TV, motorbike, radio-cassette, and other valuable assets. I understood that the condition is the result from farming without any support from outsiders or from inheritance.

There was seemingly not any extension work related to fruit tree planting or fish raising in the commune during the last years. Only a few IPM courses on rice production were organized in the area, but for a limited number of farmers. According to Mr. Pham, the farmers are not interested in participating in the IPM project because their attention is given to other activities than rice production. Fortunately, during last years the market for litchi and other fruits and fishes was still quite good and farmers in the commune are very happy with what they received.

A problem emerged in the last two years when they faced competition in selling litchi from other producers in the RRD, and especially from the farmers in Luc Ngan district (Bac Giang province) where many litchis are planted in the hill area. Mr. Pham said that although he had heard about litchi producers in Luc Ngan district, he was surprised by what the farmers in Luc Ngan have done in terms of the large area of litchis they have planted. In April 2000, during the time of his visit to his friend in Luc Ngan district, he witnessed hundreds of litchi plants in some five hectares of the hill managed by his friend's family[32]. He said: "we are going to fail in the marketplace because we are small." Although he and other farmers in the commune try to add value to their product, for example by drying litchi for selling later, this had limited success because the market for that kind of product was not stable in the last few years.

Another problem occurred in fish raising when many fishes died of a disease in the beginning of summer 2000. Many households in the commune are facing this problem but they could not do anything to resolve it. According to them, a broken irrigation network caused pollution of the water in their ponds. This situation resulted from lack of a good technical design for collective infrastructure when changing to a new land-use system by individual farmers

[32] In the semi-mountainous or hill area, average of land area allocated per family is much higher than in the RRD, it varies from 2-4 ha according to region.

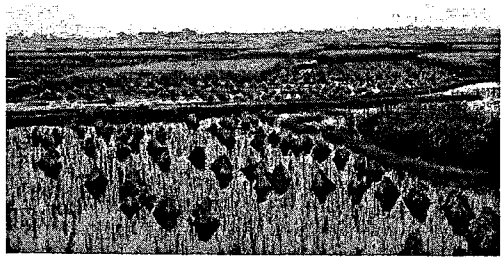
themselves. Mr. Pham said that in the past, this area had quite a good irrigation system but raised beds now replace many natural canals or small rivers.

In addition, development of winter crop production in the area of two rice crops now also faces constraints of marketing. Most of the winter products (vegetables, potato, onion, garlic, etc.) are sold on the local market when demand is apparently lower than the supply. In the commune, not only Mr. Pham, but also many other farmers whom I have visited or had a chance to exchange ideas expressed concerns about marketing. A typical statement was:

"I am not sure how long we can get profit from our farming because of the rapid increase in litchi production and problems of fish raising together with low price of winter crop products in the market. We don't know how to overcome these problems."

I understood that, in this area, farmers have been very dynamic for a long time in looking for ways to improve their living conditions. The problem they are facing today can be seen as a problem of farmers in many areas of the RRD.

## V-Who is going to help us?



**Picture 5: "Flooding-land" with unstable rice production**

My Tho is located in Binh Luc district, at sixty kilometers distance from Hanoi (see the map in Figure 3). It is known as one of poorest communes of Ha Nam province. There are 912 families living in the commune with average arable land of 2.5 *sao* (900 sq.-m) per person.

Entering the commune, one can find that poor roads and small houses with roofs made of leaves still exist. In the past, there was only one unstable rice crop planted in the spring season. The development of the irrigation system in the area during the 1960-70s has created conditions for planting two rice crops and, in some parts of the area, the farmer can plant some kind of crops in winter season. However, most of land in the commune is still "flooding-land" where the rice yield is low (3 tons/ha/season) compared to other areas in the RRD. Although food shortage now is not a problem, the low income from rice farming is worrying the people. As in other areas, increasing family demands for higher value foods (more meats, vegetables, milk, etc.), school fees, better roads and furniture, and so on, require improvement of the farmers' income.

There is a very typical case of the family of Mr. Nguyen with six members living together in quite poor conditions. The house with walls made of bricks and a tiled roof is seemingly simple inside it has no separate rooms. Two of the four their children have already finished secondary school and they are now helping their parents in farming. They stopped their study because of the high schooling costs that the family income could not cover. Mr. Nguyen is one of the experienced farmers in the commune. The family has fifteen *sao* (about 5,400 sq.-m) of arable land that is located in eight different plots of which only one *sao* can be planted with a third crop in the winter. During the last year, they planted potato in the winter instead of sweet potato as they did previously. Rice production is now enough for the family's use, for feeding animals and some surplus for sale. The farmer said that his income from selling rice could only cover the production costs such as seeds, fertilizers, irrigation fees, tax, etc., and a small saving for the family. The land for winter crop is limited. As irrigation and soil conditions are not as good as required for winter crops, the return from winter crop production is not so much.

Attempts to improve rice production with the adoption of high yielding varieties did not make sense for his family's income. According to him, new varieties require better conditions of soil and irrigation and more fertilizers than his family can afford. During 1995-1999, the family has used six different high yielding varieties recommended by local extension, but the results were limited. The rice yield of 90kg of rice/*sao*/season (2.4 tons per ha) before 1995 was increased to 110kg/*sao* (3 tons per ha) in 1999. The farmer said: "it is so difficult to intensify our farming", "we don't know where and from whom we can get better technologies."

Pig raising is a very popular activity of farmer households in the RRD. In the commune, most families raise 3-6 pigs each year for sale. However, the farmer said that they did not get so much profit from this activity. The purpose of pig raising is to provide animal manure for rice production; the return sometimes is not enough to cover the production cost because of low prices in the market. They also raised some chickens for the use of the family. Although there are many ponds in the commune and a good market for aquaculture products, only few are used for raising fish, because making a good pond is too costly for a poor family.

Through their communication network, farmers in My Tho know about communes developing new farming systems in Hai Duong province. According to Mr. Nguyen, many of them are interested in changing their land-use systems, but they couldn't get permission from the local authority for doing so. The development of non-farm activities in the commune is also restricted. Some people work temporarily as individual carpenters or constructors, but the demand for that activity in the area is low.

Apart from transfer of new technologies in rice production, local extension has organized training courses on the development of VAC models, animal raising, etc., for farmers in the commune during the last years. As other farmers in the commune, Mr. Nguyen has participated in these courses where he hoped to learn more about possibilities to improve his livelihood. He said that, in fact he is very interested in what he has learnt from the courses, especially the VAC and IPM courses. He recognized that he has learnt a lot from the IPM program that he can apply in his rice fields. However, he would like to know how to improve his farming system to get a better income from his land. He complains of the low income that his family has got from the present farming system.

According to him, farmers in the commune could not improve their income with traditional rice farming. They need to change their way of farming, but it is impossible at the moment, because the food security policy does not allow them to change rice fields to other purposes. Research findings are now available to intensify rice production, but they are not easy to adopt in the area of "flooding-land" as in My Tho commune. Extension activities operating in the commune are partly useful only for the existing cropping pattern. "I don't know who is going to help us" he said, "we are landing in an impasse".

I understood that the development of new technologies or new cropping patterns in order to adapt the lowland area is not easy. For a long time, many research projects have been conducted in that area, but the result is very limited. As in other cases in the RRD, the farmers in My Tho commune want to increase the family income by engaging in other activities than rice production.

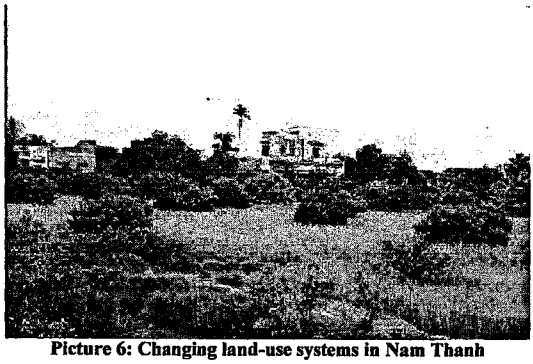
## VI-Policy implications

There are many more cases where farmers present their needs for information on different technologies and ways of farming, but the research and extension institutions in the region could not serve their needs. At the micro-level of the farming household, for the farmer it may be hard to see what will happen at the macro-level of regional or national economy in the future. However, they knew quite well what is going on in their farming systems and they are very dynamic in dealing with the current situation. From the interviewed people, I understood that in most cases, farmers are right. Problems that farmers in the RRD are facing today put questions for policy-makers, researchers and extension workers on how to meet these demands of the farmers.

**Chapter 6**
**CHANGING LAND-USE SYSTEMS IN RICE-BASED FIELDS**
**in Nam Thanh district, Hai Duong province**

This case presents farmers' innovation processes under conditions of scarce resources to deal with problems of low incomes and poverty. Thanh Xa commune is chosen as the study site where many farmers have been very dynamic and innovative in changing to new ways of farming. In this commune, while keeping a necessary land area for planting rice, farmers try to develop new models of gardening horticulture and aquaculture in the farms. These models have presented advantages, but also contain new challenges to the farmer. This case calls for the help from research and extension to resolve farmers' problems.

## I-Abstract



**Picture 6: Changing land-use systems in Nam Thanh**

As shown, under conditions of the densely populated areas of the RRD, one of the government objectives is to ensure food security for the country. Regarding the demand of food security, many research and extension programs have been designed to increase the crop yield under conditions of limited land.

The management of natural resources (such as land, water, bio-diversity, etc.) that relate to the food security issue in the RRD can be seen as a process of crop diversification. Two approaches have being applied as farmers make their own decisions: (i) **expanding winter crops production** or/and (ii) **changing land-use systems** while reserving the necessary land for rice production. In practice, many farmers are now interested in new farming systems in which fruit trees are planted together with raising fish in ponds.

It is not easy to see changes in the rice price in the past ten years because of the continuously falling value of Vietnamese currency in the international exchange. For many farmers who engage in crop diversification, rice production only contributes a decreasing proportion of their income.

For a long time, winter crop production in the RRD has become a strategy for planting higher value crops. Apart from maize, potatoes and vegetables have proved to be potential crops in the winter season. The expansion of winter crop production can be seen as one of the solutions for increasing farmers' incomes. Many farmers in the RRD have benefited from planting winter crops although their land is limited. However, in order to plant crops in the winter season (as a third crop in the year), high productivity from the two previous rice crops are expected to make sure the rice the family needs is available. That can be seen as a condition for farmers in the RRD to expand winter crop production.

Concerning food shortage problems, the government has determined that most arable lands must be devoted to rice production. Formally, planting other crops in such rice fields was not allowed although the land has been allocated to individual farmers. In some districts where food shortage is no longer a problem, many farmers try to keep a necessary land area for producing rice to meet family demands, while the rest of land is used for other purposes without getting permission from local authorities in advance. In addition, during recent years, farmers have exchanged their land plots among each other in order to make a bigger plot instead of many small ones. By doing so, some of them can easily change their land use system to get a better income. This process of changing the land use system started in the areas with poorest conditions of irrigation, soil fertility, etc. Changing the poor rice field to the raised bed system planted with diverse crop/trees, and fish raising has proved its advantages and is now becoming a good way of farming in the RRD.

Methods of making raised beds are not new to Vietnamese farmers, but research and extension works are lagging behind with what is going on in the field. The case of new farming systems explains the need for a good policy for research and extension to assist the farmers when making decisions on the development of crop diversification.

This case examines aspects of new farming systems in Nam Thanh district in the RRD to study the way in which research and extension programs can play a role in improving farmers' income. Two approaches of farming mentioned above have been chosen to represent the process of changing land-use systems for supporting crop diversification in the region: the promotion of winter crop production, and growing crops with a higher value per hectare than rice. We will look

at the role of research and extension in helping farmers to improve their situation with respect to the latter approach.

## II-Introduction

Crop diversification is defined as the improvement of present cropping patterns in which new and valuable crops are introduced. A mono-cropping pattern based on two rice crops is no longer appropriate for increasing farmers' incomes in the densely populated areas of the RRD.

In the rice-based fields, planting a third crop in the year has been considered by the government as a high potential approach to increase farmers' incomes since early 1970s. At that time, the area of winter crops was restricted because of many constraints, although most areas are quite well irrigated. In the past, a centrally planned production prevailed by using a 'top-down' approach, which operated through the co-operative system. This approach had encountered many problems in terms of organizing production, and processing and marketing agricultural products. Decision making about the process of production and consumption was in the hands of cooperative leaders. The farmers as cooperative members did not have the right to make their own decisions about which crops should be grown and where and when the product was to be sold.

New economic policies are seen as the motivation for the development of winter crop production. The allocation of land to the farmers followed-up by a series of incentive policies (for example, water was free for winter crop production during the period of 1988-1994) has stimulated them to expand their production in the winter season.

The development of agricultural technologies has also supported the expansion of winter crops. The introduction of new and high yielding varieties such as hybrid maize, potatoes, vegetables, etc., in the winter season has increased farmers' incomes. Many farmers have taken advantage from their winter crops although problems still remain such as lack of capital for investment, processing and marketing of the products.

On the rice-based fields, the development of winter crops as a source of farmers' income must be incorporated within the intensification of rice production. In most cases, the interviewed farmers set the stability of their rice crop production as their first priority for ensuring household food security.

However, the small farm size and the scattered plots in a farm are major constraints for applying new technologies and changing cropping patterns. In order to support the process of crop diversification, aspects of intensifying rice production, and exchanging and concentrating lands need to be examined. Intensifying rice production is one way to make the expansion of winter

crops possible. Exchanging and concentrating land can help the farmer to improve their cropping pattern, productivity and, in some areas, it is pre-condition for changing the land use system.

Nam Thanh is one of the typical districts in the RRD in terms of land type, production and many other socio-economic conditions. In the district, farmers have developed their winter crop production in rice-based fields for a long time. The process of changing land-use systems after the introduction of new economic policies has been seen as a good model for agricultural development. Based on improving rice productivity and winter crop production, more areas have been reserved for other activities such as planting more vegetables or fruit trees. However, no one is allowed to take rice land, being under good conditions, out of production for other activities.

### II.1-The intensification of rice production

One of the examples of the intensification of rice production can be seen in Nam Thanh district[33] (Hai Duong province). In the district, farmers have developed a good process for changing their cropping pattern. Before 1988, all attempts were made to improve rice production to satisfy food demands of the people in the district. However, in that period, the rice yields and production were low as compared to other districts in the RRD. The main cropping pattern was defined as two rice crops in the year (rice-rice), and winter crops were planted on some parts of the land.

After the introduction of the new economic policies, achievements were recorded which are better than previous period. The farmers in the district now can produce adequate rice for home consumption and have some left for sale. The food situation in the district now is more stable than before.

**Table 8 - Rice yields in Nam Thanh district (average)**

| Yield (ton/ha/year) | Period 1988-1992 | | Period 1994-1996 | |
|---|---|---|---|---|
| | Number of communes | Ratio (%) | Number of communes | Ratio (%) |
| <5.9 | 6 | 12.50 | 0 | 00 |
| 5.9-6.6 | 13 | 27.08 | 0 | 00 |
| 6.6-7.3 | 22 | 45.83 | 8 | 16.67 |
| 7.3-8.0 | 7 | 14.80 | 28 | 58.33 |
| >8.0 | 0 | 00 | 12 | 25.00 |
| Total | 48 | 100% | 48 | 100% |

Source: Le Duc Thinh *et al.*, 1997.

With regard to rice production, a survey conducted by Vietnam Agricultural Sciences Institute (VASI) on farming systems in Nam Thanh district has shown that farmers tend to reduce labor costs (see Table 9) while increasing material inputs in rice production (Thinh *et al.*, 1996). During the time of my survey of forty farmers in Nam Thanh district, the findings also showed that

[33] Nowadays, Nam Thanh is divided into two districts as Nam Sach and Thanh Ha.

a large part of the family labor has been assigned to doing other activities, including other crop production, off-farm activities, etc., from which they can make more cash income.

However, the increase of rice yield per unit of land area in Nam Thanh does not mean that farmers have full access to new technologies. It resulted mostly from improving practices by the farmers themselves. Another explanation is that almost all "flooding land"[34], that was planted with rice before has been used for other activities, such as the raised bed systems[35]. The change has reduced the area of low yielding rice crop in the summer season, and contributed to the higher indicators of average rice yield.

Concerning any new practices or new activities such as the raised bed system, it is not easy to trace which innovation scientists have introduced and which farmers have developed. In some cases, the farmers interviewed said that they have developed all aspects of the new farming models themselves without adopting ideas from research stations. In fact, research stations did not develop any model of raised bed farming (or the VAC model).

**Table 9 - Changing practices and input costs in rice production in Nam Thanh**

| | Period | | Compared in percent (%) | Reasons of changing |
|---|---|---|---|---|
| | 1991-92 | 1995-96 | | |
| **A-Material inputs** | | | | |
| 1. Seed (kg/ha) | 90 | 52 | -50% | -Reducing crop density per unit area; using new and high quality varieties; |
| 2. Urea (kg/ha) | 170 | 220 | +31% | -Increasing amount of inputs; |
| 3. Potash (kg/ha) | - | 50 | ++ | -Balancing fertilizers; |
| 4. Insecticide ('000 VND/ha) | 200 | 300 | +50% | -Higher frequency applications[36]; |
| 5. Herbicide ('000 VND/ha) | - | 110 | ++ | -In stead of hand weed control. |
| **B-Labor (man-day/ha)** | 360 | 260 | -28% | -Broadcasting 25-30% areas;<br>-Only 60% areas applied weed control twice;<br>-Using threshing machine in stead of hand;<br>-Signing water supply contracts. |

Source: Thinh *et al.*, 1996.

New varieties with high yield potential and new fertilizer products (NPK) are important elements in supporting the process of crop diversification in the area. Since 1994, however, many attempts to introduce hybrid rice varieties in the area have been made, but they are not as successful as in other districts, although hybrid rice seed was heavily subsidized. For example, in 1995 the subsidies by the local government for sowing hybrid rice in the area of 500 ha were recorded as 100 millions VND (about 10,000 US$). However, in 1996 only a very small number of

[34] Areas are inside the controlled irrigation system, but that are likely be "flooding" through the year as wetland. The farmer can only grow rice in those areas.

[35] Raised bed systems: farmers make soil beds in the "flooding-land" for planting fruit trees or vegetables, along with the soil beds they can continue to grow rice or raise fish where possible.

[36] This number was recorded before the operation of the IPM program in the district. Now insecticide use in rice has decreased considerably according to the interviewed farmers.

farmers in the district had grown hybrid rice, even though the total area of hybrid rice production in the RRD was about 100,000 ha (now this number is more than 200,000ha)[37]. Generally, the reasons are views by farmers are that hybrid varieties require a better balance of fertilizers, higher cost of seeds and are more risky under conditions of cold weather than traditional varieties. During my fieldwork, most interviewed farmers said that their strategy was to develop winter crop production to hopefully get more cash income. Their cropping patterns are designed to give priority to rice, but they must be appropriate for planting winter crops. The rotation of rice-rice-winter crops may not be suitable to hybrid rice production (information from interviewed farmers).

Due to the success in increasing rice production, two strategies have been applied to improve the farmers' situation. Firstly, in low productivity areas, farmers have started a new farming system with fruit trees (such as Logan, litchi, orange, lemon and banana, etc.), to replace the rice crop. Secondly, in the high potential areas for crop production, winter crop production has expanded into fields (still used for rice production) wherever possible.

### II.2-Winter crop production in Nam Thanh

The farmers in Nam Thanh have a long experience in cultivating winter crops. According to them, the major constraint of winter crop production is the marketing of their products. Since 1970s, they have witnessed failures when selling tomatoes, onions, garlic and many other kinds of vegetables. However, the successful production of rice enables them continuously to look for alternatives that can promote winter crop production.

In last ten years, the farmers in Nam Thanh have planted onions, garlic, maize, sweet potatoes, potatoes, and vegetables in the winter season. Since 1993, the cucumber has been introduced as a new cash crop for export under a contract with the state or with foreign agencies.

Figure 5 shows an increasing trend in the total area of winter crops in the district, especially in the period after the introduction of the new economic policies. In the winter, food crops (such as maize, sweet potatoes) and cash crops (e.g., vegetables) can give a clear indication of the two different strategies of the farmers. In the past, because of food shortage, farmers preferred to plant food crops in the winter. Today, although we can see food crops being planted, it is mostly cash crops for selling into the market. Thus, the development of winter crop production and those farmers' incomes depend heavily on the price in the free market. Unfortunately, since a long time research findings on the production and marketing of winter cash crops have not been available.

[37] The number is estimated by Department of Agro-Forestry Extension (DAFE), 2000. In recent years many farmers in Nam Dinh province have got high benefits from hybrid rice production.

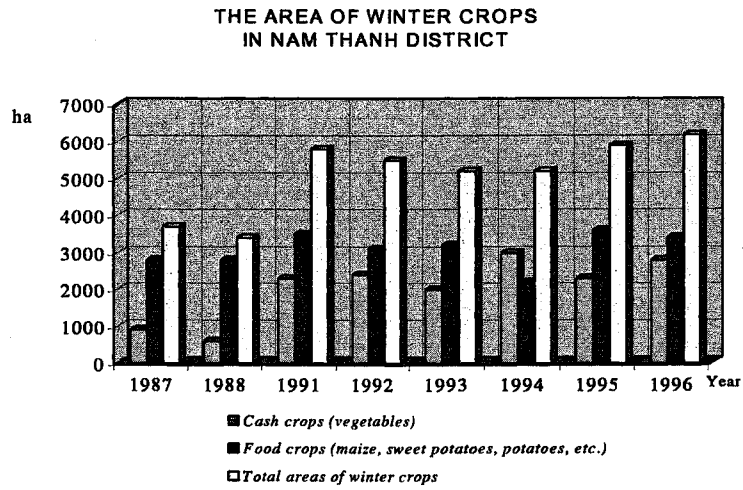



**Figure 5 - The winter crop production in Nam Thanh district**[38]

A survey on winter crops production conducted by researchers from VASI in 1996 shows different strategies of different groups of farmers in Nam Thanh. The finding was that low-income families tend to plant more food crops than those of better-off and middle-income families. According to them, the reason is that family in the low-income group is more often faced by food shortage problems (as they are often big families) and/or lack of capital for investment in planting high value cash-crops. The poor lack capacity in terms of capital, material inputs and knowledge and production skills to intensify their production and to market the products (see Table 10 below). However, the survey did not mention farmers' conditions in term of access to land where winter crops can be planted.

**Table 10 - The strategy of different groups on winter crops production in Nam Thanh**

| Group of farmers with different levels of income | Percentage of area growing cash crops | Percentage of area growing food crops | Other crops (vegetables for animal feeds, etc.) |
|---|---|---|---|
| Better-off income | 52.0 | 44.5 | 3.5 |
| Medium income | 41.5 | 55.5 | 3.0 |
| Low income | 28.0 | 60.8 | 11.2 |

Source: Thinh *et al.*, 1996. It is noted that average of cultivated land is not very different between households

After implementing new economic policies, the small division of land given to the farmers in the region as a result of the "egalitarian" policy has shown its contradictions. Cultivating many small and scattered plots reduces the productivity of crops in a unit of land. It also restricts the

[38] Source: Thinh *et al.*, 1996

application of new technologies and makes it more difficult to design and manage the production process[39]. In order to get high returns, different kinds of crops require to be planted in different types of land (i.e., low-land or up-land). Such small plots prevent farmers from effectively investing their capital and labor if it is available. That situation was one reason that led some farmers to plant food crops in most of their fields.

The 5th Conference of the Central Executive Committee of the Communist Party of Vietnam (Resolution No.5) convened in early June 1993, extended land use rights. In this Conference, rights of exchange, transfer, lease, heritage, and collateral[40] of the land-use right have been passed. That enabled farmers to invest in land reclamation, replenishment and improvement in order to multiply seasonal crops.

Before 1993, the process of exchanging and concentrating land was widely carried out by farmers in all communes of Nam Thanh district. In the area, farmers are now cultivating in one or two instead of many plots. They realized the disadvantages of cultivating in so many small plots and were willing to exchange their land location based on a family-to-family negotiation process. The extended period of land-use right and concentrated land helps the farmers to implement their own strategies.

As realized by most respondents during my survey, farmers' strategies are dependent on market demand. In the case of Nam Thanh and other districts, which I visited, planting fruit trees together with raising fish is chosen as one of the farmers' strategies in reacting to market demands. The activity of changing land-use by developing raised beds is not new in the southern part of Vietnam. In the Mekong River Delta, farmers have had good experiences in using raised bed systems for planting fruit trees (Van Mele, 2000).

The interviewed farmers in Nam Thanh said that they try to change their farming because they see many opportunities for marketing of products such as the fruit, fish, vegetables, etc. In the rice field, firstly farmers try to reduce the number of plots by exchanging with other villagers. The second step is to make some raised beds (or heaps of soil) for planting fruit trees, while rice or other annual crops continue to be grown around the tree during the first three or four years to make full use of land available. The process was mostly done by family labor. Fruit trees, like litchi, can give the first harvest 3-4 years after planting.

From time to time, provincial extension agents and other farmers in the area have visited some good models done by farmers. Unfortunately, up to now no research and extension program has been designed to assist these farmers' strategies although there are many cases that show their

[39] Everyone receives a number of plots that consists of poor, middle and good conditions in terms of soil fertility, irrigation, and distance from residential area, etc.
[40] Article 3, land law revised in July 1993.

success in improving farmers' incomes. As we know, most of agricultural research institutes in the region are dealing with technical problems of specific crops or animals (see also Chapter 8). During the time of personal discussions with researchers and reviewing the action plan of some research institutes, I found that they feel it is difficult to work on the development of agriculture in the RRD. More attention is given to (semi-) mountainous regions where the problem is clearer than in the delta and research is easily funded by government projects. Only few extension messages on very specific aspects of planting fruit trees or vegetables have been posted through mass media by research institutes. In the region, with respect to designing the new system of land use, making changes in the cropping pattern, and managing many other related elements such as irrigation, pest and disease attacks, labor, processing, capturing market, etc. A few studies have been conducted by VASI in cooperation with GRET[41].

## III-Material and methods

### III.1-Study site

In Hai Duong province, the major change in the land-use system is recorded in Thanh Ha (new district) which is the lowest part of Nam Thanh district. The new farming system has been followed by farmers in other districts such as Gia Loc, Tu Ky, and some other areas of the province. The belt of land of Thanh Ha is situated between Thai Binh and Huong rivers with about 1,800 hectares recorded as flooding-land. The major soils of Thanh Ha are alluvial soils that have high natural fertility. Thanh Ha is famous for its special litchi fruits, especially in Thanh Son and Thanh Xa communes. Due to the open market policy, the litchi fruits have been sold in many cities in the country. In rice-based fields with good irrigation conditions, the main cropping pattern is rice-rice-winter crops. Apart from long-time experience of farmers with planting litchi, other socio-economic conditions in Thanh Ha are seen as the similar compared to those in other districts of the RRD. Thanh Xa was chosen for the study as one of typical communes in the province where farmers have been very active in changing to the new farming system.

### III.2-Survey

The survey was conducted from May 1998 to April 2000 in Thanh Xa commune. A sample of forty farmers from 816 registered households (recorded in April 1998) in the commune list has been selected randomly for interview by using systematic sampling methods. The first interview was conducted in May and June 1998, and repeated (with the same interviewees) in July 1999. In March and April 2000, the previously gathered information was re-checked by the visit to all

[41] GRET: Groupe de Recherches et d'Echanges Technologiques/Programme Fleuve Rouge

previously selected farmers. In addition, the survey has been complemented by information from interviews with key informants in the commune and also in the district (other experienced farmers, commune and village leaders, and head of mass organizations such as Farmers' Union, Youth League, and local VACVINA[42], etc.).

The questionnaire aimed to assess socio-economic, agronomic and innovative aspects in the area in order to get a clear picture of the agro-ecosystem, decision-making and implementation in the process of changing the land-use system. Farmers' innovations for crop diversification received special emphasis. Other aspects of new technology, pest management, sustainability of the new system, the operation of extension work, farmers' organization, processing and marketing the products were also considered. To evaluate farmers' innovation, I also discussed their previous experiences with farming, problems, their needs and conditions for making new changes. The questionnaire was pre-tested and revised. On average, each interview took about 2-3 hours and was followed by a visit in his or her farm. In some cases, I had joined their fieldwork to save time and build good rapport with them. Due to spending a long-time in the commune, survey information regarding new farming systems were cross-checked and integrated with discussions with some groups of farmers. The farmer profile is presented in the previous chapter (Table 7 in Chapter 5). The detailed procedures used are given in the text and the tables below.

## IV-New farming systems in Nam Thanh district

When conquering new areas for growing rice, Vietnamese farmers have first dug from the land to make the foundation of a house. By planting crops and trees around their house (the so-called home garden) together with raising fish and animals, the farmer has started farming activities according to a very popular formula, the VAC model. Gradually, although still giving a low income, the VAC system has become an important part of the household economy in the rural areas all over Vietnam, especially in the RRD. Together with experiences in rice crop production, many farmers in the delta have now become experts in doing VAC activities. The VAC system can be seen as an important component of the management of natural resources in the region. In order to examine activities in natural resource management in the RRD, it is interesting to examine new farming systems that are more or less based on experiences with the VAC model.

In the VAC model, the garden is seen as an important element. In the past, agriculture in the RRD had developed under the agricultural cooperatives with complete and rapid collectivization of land and other means of production. At that time, the food shortage led

[42] VACVINA: National Association of Vietnamese Gardeners.

cooperatives to cultivate as much food[43] as possible and to give less attention to other activities. In each cooperative, the collective gardens and animal raising farms used to be organized, but poor management of the cooperative system caused low productivity and declining numbers.

As mentioned, after the introduction of new economic policies in 1988, farmers' households have been seen as the units of production. The farmers could engage in whatever activities benefited them. The farmers have gradually restored and developed their economic conditions. Together with increasing crop yields in the rice-field, they have started planting valuable crops and fruit trees in their home gardens. Many ponds have been used for raising fish as an important source of farm incomes. The VAC model now has a good potential to be further developed. Incomes from engaging in the VAC model can account for 50-70 percent of the farmers' income (see also Xuong *et al.* 1995) in some areas. The farmers' experiences with gardening help them to look for change in their farming strategy. The "V" concept has wider meaning than a home garden. Many gardens have been developed far from their houses and garden products now become more diverse than before. Successes of the VAC model can be seen as one of the good directions supporting the development of agriculture in the RRD.

**Box 1: What is VAC?**

VAC stems from the Vietnamese: it is an acronym for Garden (V), Pond (A) and Cattle Shed (C). But as it goes, 'V' has been extending to mean all kinds of land farming, in which gardening and field farming are included.

'A' stands for all activities related to water resource development and uses. So, in its implications it includes ponds, lakes, canals, springs, watercourses, etc., from which one can get such products as fish, shrimp, crabs, snails, frogs, tortoises, etc., and even water glasses (algae) following a wide range of farming practices.

'C' includes all undertakings in animal husbandry, i. e., poultry, ducks, geese, pigs, cattle, etc. In the uplands and high plateaus, 'C' may include the rearing horses, taming elephants, not excluding bee keeping.

As conceived, VAC cannot be regarded as an isolated activity in farming, it is in fact a human ecosystem in which various practices are being combined to create a 'harmonized' system wisely managed by men and women. VAC should be understood as a farming system in which all potentials are fully used in a wise manner and residues therefrom are also recycled for use. VAC in this sense is seen as an integrated farming system in which gardening, animal husbandry, and ponds have been combined to yield the best results.

As shown, problems of food shortage in the past have compelled farmers to grow rice in "flooding-land" of low productivity. The area of "flooding-land" (the area with a uncertain water level throughout the year) is estimated as about 30 percent of total arable lands in the RRD (Tinh *et al.*, 1996). Since 1970s, many research projects have been conducted with a series of new rice varieties together with practices for improving the productivity of rice in these areas, but the

[43] For a long time, food crops in the region are understood as rice, maize, sweet potato, and cassava.

success is still limited. Low income and high risks in this way of farming force the farmer to look for other solutions.

Since 1993, after the new land law was promulgated, some farmers have started new farming systems in "flooding-land". By making raised beds, fruit trees have been planted on heaps or on the boundary of fishponds. At present, there are some typical models of land-use systems in the "flooding-land" in the region, such as:

* Spring rice - Fallow;
* Spring rice - Summer rice - Fallow;
* Spring rice - Fish raising; and
* Fruit trees and Fish raising.

A study of "flooding-land" systems conducted in the period of 1991-1995 analyzed the effect of different land-use methods (Table 11).

**Table 11 - Costs and returns from different methods of land-use in flooding areas of the RRD**

Unit: million VND/ha

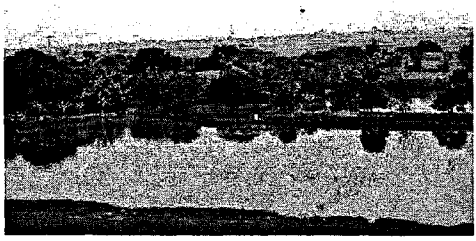
| Methods | Gross returns | Total costs (including labor) | Net income |
|---|---|---|---|
| Spring rice - Fallow | 2.916 | 0.930 | 1.986 |
| Spring rice - Summer rice - Fallow | 8.318 | 2.203 | 6.115 |
| Spring rice - Fish raising | 14.127 | 3.047 | 11.080 |
| Fruit trees and Fish raising | 44.597 | 12.944 | 31.653 |

Source: Nguyen Duy Tinh *et al.*, 1996.

In the RRD, the production of fruits has been assessed as very low compared to other regions in the country (only 5% in total production of fruits in Vietnam – Xuong *et al.*, 1995). The following constraints lead to a low level of fruit production in the region:

- Most of the gardening activities (for example, producing seedlings, techniques, capital, information, storing, processing, and marketing the products, etc.) have been spontaneously done by farmers themselves without any assistance from the state companies;
- Lack of a research system that is strong enough to carry out studies on the all aspects of fruit production and gardening;
- Lack of a good extension network that can act as an agent for the transfer of technologies for gardening; and
- Lack of policies for research, extension, production, quality control, and marketing that can promote gardening.

## IV.1-The case of new farming systems in Nam Thanh



**Picture 7: Changing land use systems in Nam Thanh**

The land in the RRD can be also divided into three main categories according to topographical and irrigation conditions such as upper-land, mid-land and flooding-land. While most of areas of the first are devoted for cultivating upland crops such as beans, sugarcane, maize, etc., the last two are used for growing one or two rice crops and some winter crops where possible.

The flooding-land is very popular in almost all provinces in the region. In the past, this land area was covered by a rice crop in spring season only and followed by unstable rice or fallow in the summer. No crop was planted in the winter in that area. In Nam Thanh district, there are 18,515 ha of the agricultural land of which more than 2,000 ha are "flooding-land"[44]. For a long time, litchi from this district has been seen as a special fruit in Vietnam ("*vai thieu Thanh Ha*" as a well-known name). In addition to the existing trees, there were 700 ha litchi planted until 1995, giving more than 3,000 tons of the fruit annually. High market demand of the litchi products is one of major factors encouraging farmers in the district (and now in other districts) to expand tree planting.

Information from the survey shows that, since 1990-1991, farmers in some communes in Nam Thanh, especially in Thanh Xa commune, have changed to new farming in the lowest fields where they could not continue planting rice because it gave a very low and unstable yield. Some good models of new farming systems appeared that presented advantages in terms of high value incomes and changing proportion of income sources (Table 12).

**Table 12 - Income sources of farmers in Thanh Xa commune 1993-1999 (in percentage, n=40)**

| Income sources | Before changing to new farming systems | After changing to new farming systems | Notes |
|---|---|---|---|
| From rice | 65.3 | 28.0 | |
| From winter crops | 18.0 | 16.6 | |
| From home garden | 1.5 | 4.0 | |
| From new farming system | - | 35.0 | in rice fields |
| From animal raising | 14.4 | 12.4 | |
| From fish raising | - | 3.0 | in home fishponds |
| Others | 0.8 | 1.0 | non/off-farm activities |
| TOTAL(%) | 100.0 | 100.0 | |

[44] District statistical records, 1995

A plan to help farmers to change rice production into other land-use systems has been designed at the district office since 1994. According to this plan, for 2,000 ha of "flooding-land" will be given permission to change the production system. Until June 1995, 523 ha were changed from the rice production into fruit trees and fish raising. At the end of 1997, the area of new farming systems in the district reached 1,700 ha (and 2,242 ha in 1999)[45]. Apart from the permission to change land-use systems, there are two main factors that affected the farmers' strategy in the district in the direction of the new systems. Firstly, the problem of food shortage has been resolved at the household level and food crops are no longer a priority for planting in the "flooding-land". Secondly, the increasing demand for other products such as fruits, vegetables, and fish, etc., in the marketplace lead the farmer to seek opportunities for improving their income.

**Box 2: Investments in raised bed systems in Nam Thanh district**

Two categories of costs relating to the raised bed systems are recorded:

1-The cost of first investment includes payment to bid for a contract to get land-use right in a "flooding-land" field (for a period of up to 50 years) and construction costs.

2-Annual costs include seedlings, fertilizers, insecticides, and annual payments. The annual payment can be seen as a kind of agricultural tax approximately 55-70 kg of rice/*sao*/year (about 1,500-2,000 kg of rice/ha/year) in the case of bidden fields.

NOTE: In cases of farmers' allocated lands, the payment is counted as the tax and irrigation fees. In the first three years, the irrigation is free of charge and the annual payment is about 270 kg of rice/ha. In following years, apart from irrigation fees, the annual payment is defined as 830 kg of rice/ha[46].

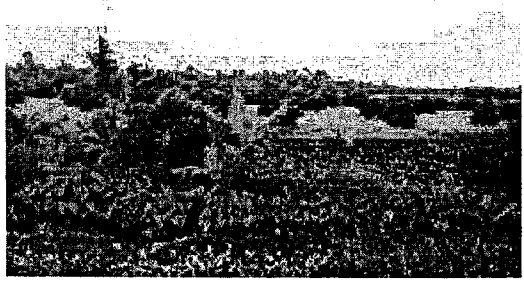
(District document, 1999 and information from the survey)

The process of making raised bed systems (making ponds and their boundaries) started after the introduction of the new economic policy in the bidden fields (renting some parts of common land) where the areas are recorded for common use or kept in reserve. Most of these areas are infertile soil or/and "flooding-land", ponds, and natural rivers that are seen as being of low potential for productivity in terms of crop production or fish raising. The first persons bidding for getting the land-use rights in these areas were seen as 'rich' farmers who had the capital to invest. Access to such capital was seen as one of bidding conditions. Winners of the bid will get the permission for using the area for a period of up to 50 years as long as they satisfy the conditions of the land-use contract. Since most of them have been successful in farming in these areas, land was no longer available to followers whose bid came late.

[45] Records from the district, 1999.
[46] District document, 1999.

The model of planting fruit trees and raising fish in the "flooding-land" has shown its advantages. Most of forty interviewed farmers in Thanh Xa who follow this model said that the return can cover all the costs of the first investment in three first years and they can get profits from the fourth year onwards. As counted by the farmers, the benefit from doing this model is between from 3 and 7 times higher than conventional farming under the same conditions. When common "flooding-land" is not available, farmers try to apply that model in their own "flooding-land" and nearby their houses to make sure their production is safe and protected from thieves.

*IV.1.1-Crops and fruit trees combined in the boundary of raised bed systems*



**Picture 8: Crops and fruit trees combined in rice foelds**

In Nam Thanh, farmers doing raised bed systems prefer planting litchi as a highest income potential activity. Other fruit plants such as papaya, banana, Logan, citrus, etc., are inter-planted with litchi. In the first years of fruit trees planting, vegetables are usually cultivated in the open boundary. The farmer can get income from the annual crops until the fruit trees cover the boundary.

As mentioned above, the egalitarian land-use policy in which a number of small and scattered plots have been assigned to a farmer can be seen as a constraint to the process of changing to new and efficient land-use systems in the RRD. When the common "flooding-land" is not available, the process of changing land-use systems in farmers' (rice) fields will face this challenge. The farmer can not make raised beds in a too restricted area. The concentration of land by exchange among farmers is the best solution for changing. Getting the larger plot, the farmer re-organizes his farm, depending on the land characteristics, the availability of other family resources and market demands. Although it is not easy to predict market demand, the farmer tries to cultivate as many crops as possible around the trees to satisfy family consumption before looking for the market for surplus products.

For a period of time, the model has become more popular in the district than any time in the past. For example, before 1993 there were 3,433 farmers in Thanh Ha[47] who changed their system covering an area of 241ha, but the number during 1993-1996 was 17,559 farmers covering 1,744 ha. Another example is in Nam Sach where the transferred area covered 47ha in 1994-1995,

[47] Nam Thanh is now re-divided into Nam Sach and Thanh Ha districts.

80ha in 1996-1997 and 124ha in 1998[48]. The raised bed system can be seen as a component or sub-system of the VAC. In some areas, the system has been applied not only in the "flooding-land", but also other are wherever possible. One now can see changing the land use system in the rice-based field, with the rice still growing alongside the young fruit-trees.

**Table 13 - Reasons for changing to new farming systems in rice fields in Thanh Xa commune (interview in 1999, n=40)**

| Reasons | Strong agree | Agree | Disagree | Strong disagree | Unknown |
|---|---|---|---|---|---|
| - Low rice yield in "flooding-land", couldn't be improved | 40 | - | - | - | - |
| - Low price of rice | 13 | 20 | 4 | 3 | - |
| - The rest of land can produce enough food for family use | 30 | 4 | - | - | - |
| - Hope new systems provide higher income | 40 | - | - | - | - |
| - New systems support a diverse family diet | 15 | 23 | 2 | - | - |
| - Found good market for products from the new system | 10 | 18 | 1 | - | 11 |
| - Experienced with VAC model | 3 | 5 | 32 | - | - |
| - Simply following neighbors | - | 11 | 19 | 10 | - |
| - Enough capital for investment in new systems | 2 | 3 | 30 | 5 | - |
| - Local government asked for changing | - | - | 6 | 34 | - |

*IV.1.2-Situations after making raised bed systems*

The information, hereafter, presents a summary of farmers' opinions and what I have observed during my fieldwork about conditions in the area engaging in raised bed system in Nam Thanh. Together with advantages from doing the new farming system, new challenges are emerging.

**The household food situation after introducing the raised bed system and the VAC model:** Information from farmers' interviews shows that food shortage seemingly is no longer a problem in the area of the new farming systems. After ensuring that the food needs of the family are satisfied and stable, the farmer starts doing new systems, but they also continue planting food crops in the old field where trees are not yet covering the land. Crops (food or cash crops), animals (pigs and poultry) and fish can be seen as components of a food security system of the household. A part of these products are used for home consumption, others are for sale. Getting more cash income and information about markets for their products becomes a major concern for the farmer. Stability of household incomes throughout the year can reduce risks caused by unfavorable conditions both in terms of natural and economic environments. Almost 70% of the interviewed farmers said they have better circumstances of life than they had before. Many farmer families in these areas now can save money for covering other costs of re-investment, housing, furniture, health care and education, etc.

[48] District document, 1999

**Environment and ecological conditions:** For a long time, rice fields have predominated as the way of farming in the RRD. In the new farming system, the farmer is now facing new challenges of pest and disease attacks. One example is the rat problem that greatly troubles the farmers in this area. The increased market demand for special foods has led to the absence of natural enemies (for example, cats, snakes, etc.). Another example is bat attacks during the maturing stage of litchi. Dropped green fruits of litchi also cause trouble for farmers. In some communes, there are problems of diseases occurring on litchi, banana, citrus, etc. Although the problems threaten the production, less damage is recorded in the areas of raised bed systems. Another example is that in the year the study taken place (2000), diseases caused by water pollution were affecting many fishponds. The damage was estimated at some fifty percent of the previous production, according to some farmers. The development of VAC (or raised bed system) may improve the balance of ecological conditions in the area, if it is well managed. There is no study on ecological conditions under the changing land-use system in the area, but one can see an improved landscape with green colors.

**Irrigation**: In some areas, where in the past the irrigation network was considered to provide good conditions for rice, problems are now appearing. Many natural canals or rivers have been replaced with the introduction of the raised bed system. Advantages from doing VAC or raised beds attract farmers but had hidden problems caused by breaking the existing irrigation network. The scarcity of land leads farmers to expand their production to other possible areas. In some areas, this situation is under control. The issue of how to maintain the irrigation network under conditions of new farming systems is still a question.

**Labor and employment**: As mentioned above, higher income from doing raised bed systems can be plowed back into their farming. In addition, farmers can now get income throughout the year and peak periods of labor demand as in rice production no longer persist. They can invest their time in seeking for related information about the production, technologies and market opportunities. By doing so, the farmer gradually improves his skills in farm management and marketing. The rural infrastructure in those areas is also improved because the demands of transportation of products increased. In this sense, the new land-use system can contribute to creating more jobs in rural areas.

**Risks**: In the areas with new farming systems, one of risks that has been recognized as marketing of farm products. Under conditions of the (new) open market policy, an unstable demand can lead to losses, such as in the case of bananas of which production was higher than demand during 1999 leading to a very low price. Individual farmers with a small production of fruit or fish, and who lack quality control, maybe less competitive in the free market. In Nam Thanh district,

farmers have shown a poor capacity for marketing their products many times (for example, bananas, local oranges, and even litchi with its short time of maturation). All products have been sold to middlemen by way of oral-contracts that are not always benefiting the producers. As a farmer said, they do not know how long they can obtain profit from the new system. Other risks such as damage caused by typhoons, floods, droughts and pest or disease attacks have appeared. Research and extension have given little attention to possibilities to reduce these risks.

**Farmers' organization**: Although attempts have been made and the *Cooperative Law* was promulgated in 1996, farmers' organizations are still limited to some spontaneously formed small groups. Corruption or weakness of the agricultural cooperative system in the past reduces farmers' confidence in all kinds of organization called "cooperative". The increased production from doing VAC model requires that farmers be better organized to strengthen their competitive capacity in the marketplace. In most cases of Thanh Xa commune, farmers are encountering problems of farming and marketing, especially when something is seen as a new in the region (for instance, new fruit trees or vegetables). Obviously, small individual farmers could not ask research and extension agencies for needed technologies if they are not organized.

**Application of new technologies**: In the region, nobody knows why the litchi gives fruits every other year (one harvest in two years), and differs in what perfect from litchi in other places such as Luc Ngan district of the semi-mountainous Bac Giang province. This problem causes problems for the farmers. In planting fruit trees in their farms, farmers have developed production techniques themselves based on their own experiences. In developing the new land-use systems, such as the raised bed system, the farmers did not receive any support from research and extension. There is only a branch of an NGO named VACVINA in the district that works on related topics, but the result is still very limited. VACVINA has been operating as a non-profit organization. Its activities are restricted to a few demonstrations and diffusion of the related information to contact farmers in the region through the branches at provincial and district levels. Obviously, they could not do all the technological services to the farmers in these fields. Lacking technological support from the research and extension service, the farmer is still perplexed when dealing with problems encountered.

Although two institutes (see Box 3 and Box 4) have been operating in the areas of food crops, vegetables and fruit trees, their research projects depend heavily on the limited resources such as staff and funds allocated from the MARD. On the other hand, as mentioned above, small individual farmers with small amounts of resources available could not call for research. Only two of the forty interviewed farmers said that they sometimes come to the research station to learn some planting techniques and to buy new seedlings. Most of their knowledge on the production

techniques are accumulated in the course of farming as "learning by doing" and learning from neighbors.

**Box 3: Functions and Tasks of the Research Institute of Vegetables and Fruit**

- Study, breed, select and produce the various varieties of vegetables, fruit trees that are guarantee original standard, clear of disease, good quality and high productivity.
- Build and guide the cultivating process, build-up the seedling nursery of various fruit trees, vegetables and ornamental trees.
- Study, design and improve post-harvest technologies for vegetables and fruits.
- Study and plan for the development of specialized regions of vegetables and fruits.
- Organize links, joint ventures and international cooperation for the transfer of technologies on vegetables and fruits.
- Analyze the physio-chemical norms and basic composition of vegetables and fruits.
- Take part in staff training in the field of vegetables and fruits.

(*Scientific and Technical Research Development Institutions*, Special No. 98. Hanoi, 10-1998)

**Box 4: Functions and Tasks of the Food Crops Research Institute**

- Research on variety improvement and intensive production technologies for food crops and on appropriate cropping patterns for various ecological regions.
- The main research activities focus on technical aspects of rice, root and tuber crops (potatoes, sweet potatoes, cassava, etc.), legumes (soybean, mung bean, French bean, field pea, etc.), vegetables (tomatoes, watermelons, cucumbers, cabbages, etc.) and some special fruit trees (jujube, litchi, Logan, etc.).
- Produce original varieties and do the transfer of technology in these fields.

(*Scientific and Technical Research Development Institutions*, Special No. 98. Hanoi, 10-1998)

## IV.2-Implication for policy theory

In the direction of land reform policy, the farmers try to improve their own situation. The farmers' choices in expanding winter crop production and changing the land-used systems in the region reflect the lack of a good policy for promoting crop diversification. The farmers, being in the vanguard of the movement for changing the land-use system can become richer and be more aware of new farming practices. In recent years, a high market demand for fruit and fish products existed in the region. This encouraged more farmers to adopt the new way of farming. However, nothing is certain about the stability of the market in the future.

The development of VAC or raised bed systems with more fish, meats, eggs, fruits, etc., produced is gradually making the aggregate supply of these products larger than before. This situation may lead to an over-supply of products in such a way that may lead to the reduction of

farm-prices and then of farmers' incomes. In that case, changing for other alternatives in the VAC or raised bed systems is not easy and may become a serious problem to the farmer because the process requires more investment. There is not any recommendation from research and extension work in this field in order to assist farmers who were or will be involved in the process of changing land-use systems, both in terms of technical and socio-economic aspects.

**Picture 9: VAC model in Tien Tien commune, Nam Thanh**

Farmers see the raised bed system as an innovation that does not come from research and extension, but was developed by themselves. Also, farmers do the diffusion of the innovation themselves without any assistance from extension works. Through information from mass media communication and other sources, adopters come to visit successful farmers in the area. During the visit, they can observe, witness and learn a lot from the farming experiences of others. However, for new adopters, it is not easy to make decisions about choosing plants, animals/fish and crops and also of techniques to be applied. They may need to be trained.

It is very clear that almost all research findings from above mentioned research stations are technical in nature. In a research project, there are only some remarks related to economic aspects of the technique mentioned. During interviews, researchers do not know exactly what they should do because they lack information on farmers' needs. Similarly, the extension workers in the area do not have any reactions to the needs of their farmers because most of them are only familiar with crop production, but not with horticultural or animal production.

*Productivity*

In a region such as the RRD, productivity is not only counted by the yield of individual crops or trees. Higher productivity per unit area is the major concern of farmers because they have very small farms. The interviewed families treat land productivity in terms of the total value of income from farming a unit area. By switching to the new farming system, farmers can improve their incomes in areas with low potential crop yield. Returns from raised bed systems are recognized as high (see Chapter 5 in the case of farmers in Thanh Xa commune). There are many models of farming with different choices for farmers. The farmer also prefers to add value to his/her products that can be sold after simple processing, and be produced in specific areas. This

activity can have secure demand at the market and make a product that can easily be collected for sale. The farmer can develop some simple processing of their farm products such as making sauces, or soya-curds, drying fish/meat, etc. So, from doing the new model of farming, new and diverse products can be made and more jobs are created with much higher incomes per unit of land.

Unfortunately, no research has been done to compare different models of the raised bed system adopted in the region. The choices for the types of trees or crops which are to be planted, and the method of fish raising to be used in this system is mostly based on farmers' experience and on market demand.

*Equitability*

The situation of access to the land and advantages from applying the new farming model is not the same for every farmer in the region. A policy for promoting winter crops in rice-based fields or changing to raised-bed systems does, of course, not create opportunities for a balanced income for every farmer. As already mentioned, the vanguard often comprises better-off persons who have the capital and means of production and who can get more benefit from selling his/her products at high prices when fruit trees of his/her followers do not give a harvest yet. On the other hand, the land where farmers can make implement is not always available for every family. The good quality of some special fruits such as longan or litchi is only found in some specific areas with favorable soil conditions.

In the meantime, the market demand for products such as fruits is high and the farmer can get quite a good harvest from planting fruit trees. However, in the long run nobody can predict what will happen with the market of his/her longan and litchi fruits for which the harvest time is very short. The situation is the same for other VAC system or winter products such as fish, pork, chicken, vegetables, etc., when many farmers try to increase their production. There is a disparity of income between families doing the VAC model and others who do not have the right conditions such as land, capital and labor to do so. Questions are being raised with respect to the equitability of this development in terms of participation and getting permission for making the change. If the new farming system in Nam Thanh is seen as a pilot program, who will be involved in the process of designing, implementing, monitoring and evaluation this program? If the model is recognized as good, why are farmers in other provinces not given the permission to change? And so on.

*Stability*

This measure refers to the stability of farm incomes derived from winter crops production or raised beds. A lost harvest and low income caused by a typhoon, or a low price of the product

affect the development of the system. Another problem is intermittent harvest of litchi in Nam Thanh which cause difficulty for the farmers. In most cases, a low harvest from the VAC system is caused by the fact that necessary farming technologies are not available in the area. The risk from the low level of technologies applied in the raised bed systems is caused by the lack of a realistic research and extension policy. This is one of the constraints causing instability.

*Sustainability*

The lack of studies on the new land-use system leads to non-availability of advice on how to make the system sustainable. Water conditions (irrigation and drainage), pest and disease status, and the long-term effects of the new land-use systems do not as yet attract attention from research stations. In the survey, twenty-five of the forty interviewed families who plant litchi in Nam Thanh district use an amount of chemical insecticides to protect their trees that is ten times higher than that used in rice. Based on experience with pests and disease attacks, the litchi farmers often spray at least three times before or/and after the blooming stage of the tree without being aware of whether the pest occurs or not (information from interviews). Non toxic index from insecticides used in the area is recorded. In that area, most of gardens and fishponds are nearby the farmers' houses. The technical performance of the system is not yet well understood by the farmers because they are trying to develop this innovation. They do not know whether their choice of practices, seedlings and/or animals is appropriate and effective. With respect to marketing the product, most interviewed farmers answered that they do not know how long they can get profit from applying the new systems, especially when they have to compete with other litchi producers in Luc Ngan district (see also Chapter 5). Nobody can be sure that the system will be sustainable and give a high income in the long-term.

**Table 14 - Proportion of main products for sale from interviewed farmers in Thanh Xa commune 1993-1999 (in percentage, n=40)**

| Products | Before changing to new farming systems | After changing to new farming systems | Notes |
|---|---|---|---|
| Rice | 15.8% | 5.6% | Areas for rice production are reduced |
| Potatoes | 33.1% | 40.3% | |
| Fruits | 75.0% | 80.2% | |
| Pigs | 100.0% | 100.0% | Pigs for sale only |
| Fishes | - | 60.5% | |
| Vegetables | 77.0% | 69.5% | |

The above discussion shows that, in the meantime, in the trade-off between different levels of properties of the agro-ecosystem in the region, more attention is given to the productivity of land

at the expense of other objectives. Table 14 presents information from forty interviewed farmers in Thanh Xa commune, in which the proportion of sold products reflects the farmers' objectives.

## IV.3-Communication about the new farming system

The government program to ensure food security in Vietnam has been designed and implemented for the period of 1996-2000. In this program, the diversification of crops is one of the major activities to ensure food security in the country. The program reflects the government's objectives and some related projects have been prepared and implemented. However, although crop diversification is mentioned, the productivity of food crop production is the highest priority of the government. That explains why the government has stopped giving subsidies for the promotion of winter crops (for instance, in the winter season, farmers now have to pay an irrigation fee), and give very limited permission for changing the land-use system in other provinces such as Ha Nam, Ha Tay, Nam Dinh and Ninh Binh where much "flooding-land" is available.

**Table 15 - Sources of information about innovation, production and market in Thanh Xa (n=40)**

| Statement on sources of information | Strong agree | Agree | Disagree | Strong disagree | Unknown |
|---|---|---|---|---|---|
| - Research and extension is the most important source of information | - | 5 | 32 | 3 | - |
| - Neighbors and local experimentation are the most important source of information | 18 | 15 | 7 | - | - |
| - Much information comes from traders, mass media, etc. | 16 | 21 | 3 | - | - |
| - I learned new models from neighbors and adapted them myself | 14 | 18 | 5 | 3 | - |

One of the important causes for the development of different objectives between the government and farmers is the lack of information on what is going on in the field. There are weak linkages between research and extension and especially between research and farmers. One can see a "top-down" approach of research and extension. Feedback is not commonly shown in the process of government project/program implementation. At the Ministry level, the Science and Technology Department works as an administrative office which is unable to provide good consultancy to assist policy-makers in designing more realistic policies.

One example is that the government-approved projects for promoting crop diversification are based on information gathered from different sources, but less attention has been given to see what farmers do themselves. The main source from which policy-makers can gather information on crop diversification is from annual reports on the performance of research and extension projects that are normally technical in nature. In this manner, the statistical office at the provincial level provides the data up to the higher level (Ministry of Agriculture and Rural Development). These

data are combined with information from research and extension agencies in the process of formulating policies for subsequent programs.

On the other hand, farmers do not know exactly what research and extension policies are about. Interviewed farmers said that they understood that the government wants to promote food security. However, they do not know why the government does not give them opportunities to change the way of farming when food shortage is not a problem anymore. They want to change because they need to get more income from other farming activities to satisfy increasing family needs. They known that under conditions of open market economy, the markets for their products may improve.

In the region, the farmers have understood that thanks to many of the new technologies that they have adopted in recent years, their production and living conditions have gradually improved. A series of new and higher yielding crop varieties provide an excellent opportunity to increase their income. Regarding crop diversification, the farmers know that the winter crop production is now getting better returns due to the introduction of new crop varieties by research and extension agencies. However, they have never been given any opportunity to participate in decision-making on technology development and extension strategies.

Seventy percent of the interviewed farmers have shown their interests in technological and marketing information that can help them to resolve problems of farming in the winter season and applying new raised bed systems. There are very few training courses on production techniques provided by the extension station or by some non-government organizations in the district.

## V-Conclusion

Although many attempts have tried to improve the land-use systems in which winter crop production is expanded and raised bed (or VAC) models are applied, imported fruits from outside the country, especially from China, still dominate the marketplace. This implies that a market for products from internal production of winter crops and/or VAC farming is available.

In the past, intervention by research and extension in the process of changing the land-use system was very limited. For developing new farming systems, farmers need assistance from extension and research and they should participate in the process of technology development. The farmers' participation in this process is very important when the government research institution could not cover the costs and conduct on-farm trials and demonstrations in different specific areas of the region. Long time experiences in farming may be best source of information for the adoption of new technologies.

The trade-off between different properties of the agro-ecosystem in the region such as productivity, equitability, stability and sustainability in the application of the new farming system is a very important factor. In order to run the new system, the farmer has to invest more family resources such as capital, labor, etc., over a long time. Failure may lead to serious problems for the farmers. Risks of this happening are caused by unfavorable weather conditions, but also from adopting a wrong technique or when the market can not absorb the demand.

This implication is very important for the policy-making process. The existing policies for the promotion of crop diversification are necessary, but not enough. They are mostly based on technical aspects, but neglect the socio-economic conditions that also are important. For research and extension work, it is desirable to give attention to:

* Land (type of land, soil quality);
* Water (quantity of water or security of water, water quality);
* Environment (pesticide and its waste);
* Market demands;
* Economic evaluation;
* Processing and changing consumption habits;
* Impacts of crop diversification;
* Resources and goals of different groups of farmers;
* The role different family members play in the production process; and
* The social structure of the community and, e.g., the way this influences collective decision making.

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**Chapter 7**
**NEW TECHNOLOGIES AND THE CHOICE OF FARMERS - the case of True Potato Seed (TPS) production in the RRD**

This case presents government efforts to develop technology to support winter crop production as a part of the diversification program. In the case, described adoption of the TPS technology is still questioned because of the technical aspects of the project itself. The case asks for a new research and extension approach, which uses a knowledge system perspective to address problems of small farmers in the region.

## I-Abstract

**Picture 10: Potato production in the winter season**

Since the introduction of a market economy and private farming in 1988, agricultural productivity in the RRD rapidly increased both in terms of crop intensity and yield, although the technical background regarding the increase has not been examined. District and provincial food self-sufficiency was traditionally the main planning target that most authorities tried to achieve. Apart from rice production, a plan prepared by MARD[49] for the RRD up to the year 2000 is to grow total of 150,000 ha of maize, 100,000 ha of sweet potatoes, 50,000 ha of potatoes and 50,000 ha of vegetables, but it does not indicate the winter crop production. Winter is seen as a very important crop season, because of its potential for an extra crop after harvesting two rice crops in the rice-based field. The plan also focused agricultural research on priority areas such as hybrid crops (i.e., rice, maize and potato), pest and disease resistant crop varieties, IPM, etc[50].

[49] MARD: Ministry of Agriculture and Rural Development.
[50] Plan for the year 2000. Project document, MARD 1995.

As mentioned in the previous chapters, average farm size in the RRD is small and the per capita income is still low. For a long time, many efforts have been made to try to solve this problem. One of feasible solutions is the expansion of areas under winter crops. A program to promote winter crop production in the RRD has been implemented by different research and extension organizations. Apart from improving winter maize production, TPS-based production[51] is one of major concerns of technology development and extension projects in the region. However, TPS technology is not always welcome by different groups of farmers and the adoption rate varies from place to place.

This case looks at official innovation efforts with respect to TPS technology development and extension to diagnose why many farmers do not adopt this technology. Data were collected from many different sources in agricultural research and extension agencies and by interviewing related people (unfortunately, the data for the last few years are not available in the General Statistical Office[52]).

The analyses are based on detailed work during 1998-2000 at the farm level, and on working with individuals and groups of farmers, representatives of communes, villages and co-operatives, researchers and extension workers, and others who are responsible for designing programs. The benefit derived from this study should enable actors to look for a better way to prepare and implement research and extension programs in the expansion of winter crop production in the region.

## II-Introduction

Potato was first grown in the RRD of Vietnam in 1890 and the area under production steadily increased until 1979 when it peaked at 93,000 ha and rice crop losses were great due to flooding (Ho *et al.*, 1987 & 1996). In the aftermath of the war, the area under production declined precipitously, but it has grown steadily since the introduction of the *Doi Moi* policy in 1988. It is estimated that 400,000 ha could be used for potato production in a rotation of Rice-Rice-Potato in Vietnam (Ho *et al.*, 1993). Potato production currently stands at about 35,000 ha, of which 98 per cent is in the RRD. However, the average yield recorded is very low: 8-10 tons/ha.

As shown in the previous chapter, agricultural land per capita in the RRD stands at 0.04 ha/person, well below the national average of 0.11 ha/person. This situation makes food security tenuous in some provinces, and food shortage is still a concern, particularly when flooding caused by typhoons delays the harvest of summer rice and shortens the winter cropping season.

[51] The use of the botanical true potato seed in the winter potato production.
[52] General Statistical Office (GSO) is a state agency providing statistical information.

**Table 16 - Area under potato production in the RRD**

| Province | 1988 | 1989 | 1990 | 1991 | 1992 | Average Area (ha) |
|---|---|---|---|---|---|---|
| 1. Hanoi | 2,047 | 2,292 | 3,048 | 2,940 | 2,480 | 2,561 |
| 2. Ha Tay | 7,970 | 7,425 | 8,026 | 6,722 | 5,402 | 7,109 |
| 3. Hai Hung | 9,023 | 6,841 | 7,685 | 6,376 | 4,960 | 6,977 |
| 4. Hai Phong | 990 | 958 | 804 | 1,212 | 781 | 949 |
| 5. Nam Ha | 3,864 | 3,693 | 3,714 | 3,753 | 2,852 | 3,575 |
| 6. Ninh Binh | 350 | 350 | 405 | 319 | 486 | 382 |
| 7. Thai Binh | 4,329 | 4,932 | 5,924 | 3,946 | 3,071 | 4,440 |
| 8. Ha Bac (11 districts) | 4,138 | 3,586 | 3,947 | 3,861 | 3,245 | 3,755 |
| 9. Quang Ninh (4 districts) | - | 7 | 2 | - | 300 | 103 |
| 10. Vinh Phu (6 districts) | 504 | 740 | 1,633 | 1,428 | 1,256 | 1,112 |
| Total | 33,215 | 30,824 | 35,188 | 30,557 | 24,833 | 30,923 |

Source: *GSO* and *Binnie*, 1994.

In the last decade, the farmers in the RRD have been successful in expanding food production, but they still worry about their low incomes and poverty. However, the potential for intensification in the RRD is limited by climatic conditions. Up to now, no other crop can produce an equivalent yield (both in value and production) to potato in a three-month period under RRD conditions of low temperature and low light intensity. Most interviewed farmers hoped to get more cash income from introducing winter crops than what they get today. As mentioned, potato as one of cash crops growing in the winter is one of the concerns of many farmers of the RRD.

**Table 17 - Profile of five hundred farmers' households producing potato in the RRD**

| Items | Unit | Average |
|---|---|---|
| 1-Household members | person | 5.31 |
| 2-Household labor force | person | 2.35 |
| 3-Total arable land | m2 | 2,186 |
| 4-Number of crops grown/year (land utilization co-efficient) | | 2.53 |
| 5-Total area under crop production (3 x 4) | m2 | 5,528 |
| 6-Area under food crops | m2 | 4,695 |
| 7-Area under vegetables | m2 | 735 |
| 8-Area under other crops | m2 | 100 |
| 9-Area under potato | m2 | 288 |
| 10-Potato utilization purposes: | | |
| • Sale | % | 55 |
| • Home consumption | % | 40 |
| • Animal feed | % | 5 |
| 11-Gross return from potato per household | VND[53] | 473,000 |
| 12-Net benefit from potato | | |
| • per household | VND | 176,000 |
| • per hectare | VND | 6,131,300 |

Source: *Institute of Agricultural Economics (IAE)*, 1995[54].

The possibility for increasing potato production in the RRD has arisen from the introduction of new, early maturing rice varieties, which enable farmers to grow an additional

[53] VND – Vietnamese currency with 11,000 VND equivalent to 1 US$ in 1995.

[54] Institute of Agricultural Economics, 1995: data from a survey of 500 vegetable producing households in Hanoi, Ha Tay, Hai Hung, Ha Bac and Thai Binh provinces of the RRD.

winter crop after two rice crops in the year. In the past, potatoes have been classified as a food security crop and are considered important in the regional self-sufficiency balance when rice production cannot cope with food demand.

In the RRD, the potato production can contribute to household's food self-sufficiency because of its relatively high productivity. As a high value crop, potato also provides farming households with a source of income, accounting for 50 per cent of total household income in some areas, giving more profit than vegetable crops such as cabbage and tomato with 25 and 24 percent respectively (IAE, 1995).

### II.1-Problems of seed supply

Seed has been identified as the major limiting factor and as the most expensive component of potato production in Vietnam (Schmiediche, 1997; Ho *et al.*, 1990; 1991; 1992 & 1993). Although farmers in the RRD have success in the use of diffused light storage to store seed tubers for up to nine months, the hot weather conditions often cause a loss of about 30 percent in weight and another 20 percent resulting from diseases. Hence, nearly 30 percent of the harvested crop needs to be kept as seed for the next season (Hoang *et al.*, 1987).

In order to solve seed storage problems, many studies have been conducted to identify seeds that can reduce storage losses, to improve storage methods, and to experiment with planting potato in the spring season, planting potato in the highland of SaPa (a mountainous region in the North), etc., but the success is very limited. At present, the improvement of the seed supply systems is still a critical issue.

Since 1981, in collaboration with the International Potato Center (CIP), the Vietnamese Government has established the National Potato Program. The program's objectives up to the year 2000 were to:

a) increase national potato production from 200,000 tons in 1981to 350,000 tons annually, of which 30,000 tons are to be exported;
b) expand seed production, so that 40,000 hectares could be grown with improved quality seed;
c) improve crop yield;
d) identify superior cultivars; and
e) train research and extension staff (Ho *et al.*, 1987 & 1993).

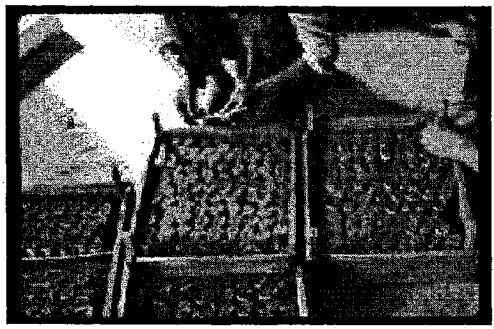
In view of the adverse agro-ecological conditions under which seed potatoes are produced in Vietnam, the CIP and the National Potato Program have agreed to test the newly developed hybrid TPS technology in the RRD since 1993 (Schmiediche, 1997). The program has been

successfully implemented in different locations of the RRD, but its expansion is still limited. This situation raises questions with respect to research and extension policies regarding TPS-based production.

## II.2-Conventional production and attempts to improve seed supply systems

Up to now, ninety per cent of the total potato area in the RRD is planted with local *"Ackersegen"*, or *Thuong tin* in Vietnamese, introduced by the French since 1929 (Ho, *et al.* 1987; 1996). The variety has dominated the potato acreage in the RRD because of its excellent storage and culinary qualities, and no alternatives are available to the producers. However, since 1982 this variety has been severely degenerated and yields are far below what would be obtained if disease-free seeds were available. Attempts to eliminate diseases from this variety through tissue culture were foiled by rapid virus re-infection rates due to the high incidence of insect vectors in Vietnam.

Since 1971, the German Democratic Republic (GDR) had provided several potato cultivars with an annual 100 tons of the seed-tubers called *Marriella*. However, the cultivar had a faster degeneration rate, poorer storability, and less preferred eating qualities than those of *"Ackersegen"*. On the other hand, dependency on seed supply systems from outside country was not always beneficial to the farmers. This resulted in a slow expansion of this cultivar in the RRD.



**Picture 11: Potato sprout cuttings**

Training at the CIP regional office, in the Philippines, led Vietnamese researchers to study the possibility of using sprout cuttings with clean seed-tubers in 1984, which was followed by its application in some areas in the RRD. Sprout cutting was to overcome a shortage of planting materials and an attempt to reduce production costs. The seed-tubers stored for 7 to 9 months provided a good source of vigorous sprout cuttings. In the period of 1984-87, sprout cuttings proved to be good mother plants for the production of apical cuttings. The yield from cuttings could compete with those from seed-tubers, growing-up to 20 tons per hectare. The use of sprout cuttings had provided an additional 600 tons of the clean seed for distribution in 1987 (Ho *et al.*, 1987). The success of sprout cuttings partly resulted from the government's subsidy to the farmers who grew potatoes using sprouts. This approach had many constraints (for instance, requirements of high skills in sprout cutting activities, lack of time to do a proper job, easy virus infection, etc.) which farmers can not easily overcome. On the other hand, a technical problem in sprout cutting is the non-

adaptation of the cultivars *Marriella* and *Ackersegen* to short days and cool temperatures during December and January (Ho *et al.*, 1987b).

Research on TPS-based potato production was initiated by the Food Crops Research Institute (FCRI) in 1978 (Hoang *et al.* 1988), and then joined by the Potato and Vegetable Crop Research Center (PVCRC), and Hanoi Agricultural University (HAU). The approach is based on *open-pollinated TPS*. In 1986, 40 kg of the seed was sown. The objective was to develop a rapid low cost method of TPS-based production, and to obtain a high multiplication rate in seed-tuber production per unit area planted for seed-tuber purposes. This approach was considered as a possible alternative for alleviating problems of unavailability of quality planting materials. In the hills of Da Lat (in the South of Vietnam), open-pollinated TPS could be obtained from farmers' fields. However, this approach was recorded as successful with only approximately 50 percent of the producers (Table 18). In that period, the failure was explained by lack of experience with nursery management, growing potato under too wet or dry conditions, etc. In addition, the progeny was extremely sensitive to short cool days that caused plants to tuberize very quickly, limiting canopy development and resulting in low yields. Furthermore, the warning is that the next-generation tubers does not store as well as the local cultivar *Ackersegen* (Hoang *et al.*, 1987). This results in a lower multiplication rate than what would be expected.

**Table 18 - The open-pollinated TPS in the RRD 1984-1986**

| | Year | | |
|---|---|---|---|
| | 1984 | 1985 | 1986 |
| TPS distributed (kg) | 0.35 | 21 | 40 |
| Number of participating co-operatives (#) | - | 43 | 41 |
| Transplanted area (ha) | - | 52 | 120 |
| Harvested area (ha) | - | 30 | 60 |
| Yield (ton/ha) | - | 5 | 6 |

Source: Hoang *et al.*, 1987.

At present, other attempts to *import seeds from France, the Netherlands and China* have not been successful due to lack of an effective system for the rapid multiplication and distribution of clean seed (see also the next section). Newly developed varieties have not been extensively used by farmers because of the slow rate in seed multiplication and the high cost of high quality tubers available to growers. These situations cause potato production to remain low in terms of profitability because the seed-tuber expense often account for 40-50 percent of total production cost of the crop (Ho, *et al.* 1987; 1996). The availability of high quality potato seed is, therefore, one of the critical factors to improve potato production.

## II.3-Hybrid TPS technology

The potato is likely to become one of the most important food crops in Vietnam, as it does not compete with rice for land. However, there are two major inter-related problems that need to be addressed to enhance potato production in Vietnam, first, the development of appropriate post-harvest technology (processing and storage) and second, the availability of good quality seed for which the hybrid TPS technology was designed as an alternative seed system (Tung & Ho, 1995).

A solution to the seemingly interactable problem of how to maintain a supply of clean seeds under RRD conditions has been developed by CIP and introduced to Vietnam by the Root Crops Research Center (RCRC). Potato production from hybrid TPS now can be seen as an alternative to production from traditional seed-tubers. It was initiated in 1993 and has been adopted by thousands of farmers in the RRD (Ho *et al.*, 1996). A clean seed supply is maintained by planting disease-free botanical seed and growing a maximum of two generations of potatoes from TPS-derived tubers. In this manner, the incidence of major seed-borne diseases such as bacterial wilt and viruses is drastically reduced. The causal agent of bacterial wilt (*Pseudomonas solanacearum*) survives in the soil and potato tubers may be infected without manifesting symptoms. If these potatoes are used as seed, the new crop will be infected. Likewise, potato plants maybe rapidly infected with viruses regardless of their origin. The advantage of TPS-based as a seed source is that seed-borne diseases can be continuously "flushed out". The use of hybrid TPS is to overcome the weaknesses found in the previous technology using open-pollinated TPS that was carried out on a large scale in the RRD during 1985-88.

Crossing parents that have been specially selected for their disease resistance, agronomic, culinary and other key characteristics, produces the (botanic) hybrid TPS. The resulting genotype is called a TPS progeny. Late blight caused by the fungus *Phytophthora infestans* is the most important potato disease worldwide. Resistance to this disease has been incorporated into TPS progenies and is a major advantage of the TPS-based potato production. As mentioned above, potato seed-tubers in the RRD have to be stored for a long period before being planted. This storage time coincides with the hottest period of the year, which is detrimental to the physiological quality and phytosanitary hygiene of potato tubers. Therefore, the possibility of growing a ware crop directly from hybrid TPS-based transplants is seen as a highly acceptable alternative to the conventional and non-formal seed system. A national program for hybrid TPS technology diffusion was set up in 1993, with the VASI and the FCRI as the two main state agencies responsible for carrying out the implementation nation-wide. In this context, Vietnamese researchers focused initially on only two areas:

1) The diffusion of the hybrid TPS technology through farmer-led technology transfer, and
2) Hybrid progeny testing for the selection of promising progenies for eventual recommendation and release to farmers.

When studying the performance of the G1[55] tubers, it has to be realized, however, that those tubers, harvested from TPS-based transplants the year before, were also stored for the same length of time and under the same conditions as the local *"Ackersegen"*. Vietnamese researchers have unanimously come to the conclusion that the production of tubers from transplants constitutes a new seed system for the RRD, and that they will not go beyond G2 for ware production in order to avoid seed degeneration of any kind.

The (botanic) TPS is obtained from commercial seed companies in Chile and India. The cost of (botanic) seed depends on the TPS progeny and varies from 800 US$ to 1,200 US$ per kg. The RCRC has tested forty progenies in Vietnam by distributing seedlings to farmers for comparison and obtaining feedback on their preferences. Since 1996, VASI researchers have started to concentrate strongly on the production of (botanic) hybrid TPS in Vietnam with CIP assistance. Objective of the Pilot Project is to produce seedling tubers and a certain proportion of ware potato in the first generation (Go). The resulting seedling tubers are then used as seeds to produce ware potato in two succeeding generations (G1 and G2).

**Table 19 - Results from Pilot Production Project in the period 1993-1996**

| Item | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| Amount of (botanic) TPS used (kg) | 0.9 | 1.8 | 8.6 | 33.8 |
| Area under Go (ha) | 4 | 12 | 71 | 356 |
| Area under G1 (ha) | | 16 | 86 | 586 |
| Number of farmers household involved | 273 | 668 | 4,000 | >17,000 |
| Number of cooperatives/communes involved | 7 | 7 | 24 | 300 |

Source: Ho *et al.* 1997.

Profits from TPS-based potato production have been estimated as much higher for Go and G1 respectively than traditional production from seed-tubers (Ho & Dam, 1995).

## II.4-Competition between seed supply systems for potato production in the RRD

During the last few years, although researchers do not recommend to use Chinese seed-tubers, and the seed can be produced locally, the MARD has signed quotas to import 7,000 tons seed potato from China annually for planting about 3,500 hectares in the region. The estimated proportion of seed potato imported (both formally and informally) from outside countries such as China, France, Germany and The Netherlands can provide seeds for less than 4,000ha in the comparison with total cultivated areas of 30,000ha per year. Other solution, such as the TPS

[55] Original Generation (Go) is from Botanical seed (TPS), the first Generation (G1) is tubers derived from Go, and the second Generation (G2) is tubers derived from G1.

technology, only supplies about one thousand hectares per year with botanical seed and several thousands hectares of TPS-based production. Thus, the local "*Ackersegen*" variety still predominates in the field with heavy disease infection and low yields.

There is an informal seed supply system for potato producers, which mostly consists of agricultural extension networking in the RRD. Based on the prediction of farmers' demands for winter potato production, from August almost all agricultural extension centers at provincial level and stations at the district level in the RRD send their staff to look for sources of seeds. Apart from seed potato sources from farmers themselves, most of them seek ways to import from other countries, especially China. During the last few years, importing seed potato from China is becoming an important source to compensate for the lack of seed potatoes inside the country. As long as the advantages of TPS are not demonstrated to the farmers, and the government does not have a good policy to promote the use of TPS, they will continue using conventional and Chinese seeds as was recognized by interviewed farmers in Nam Thanh district during my survey. This situation leads to low yields and considerably reduced farmers' incomes. The issue relates to the way by which research and extension network can be re-organized, to the resources allocated, and to other related policies for promoting potato production with high economic visibility.

## III-Materials and methods

### III.1-Study site

In the RRD, the major potato production is recorded in Thai Binh, Hai Duong, Hung Yen, Ha Tay and Nam Dinh provinces. In these provinces, farmers see winter crops as their opportunity to compensate for the small size of land. Together with potato, crops such as maize, sweet potato, and vegetables, etc., have been planted in rice-based fields in the winter. Generally, the socio-economic conditions for the development of winter potato are the same in these provinces. In last five years, although the TPS pilot program operates only in some restricted districts, the technology has been adopted in other areas of the RRD. Trong Quan commune (Dong Hung district, Thai Binh province) is one of communes that participated in the National Potato Program, and most farmers adopted TPS in the winter. Therefore, this district was chosen for this study so as to understand how applicable the new technology is under farmers' conditions. The second site for this study is Thuong Tin district, Ha Tay province, where many farmers (especially in Ha Hoi commune) are still interested in the traditional potato production. During my fieldwork in other districts such as Y Yen (Nam Dinh), Binh Luc (Ha Nam), Chau Giang (Hung Yen) and Nam Thanh (Hai Duong) related issues of potato production and TPS technology were also looked into to add information to two main study sites.

### III.2-The interview

The interview was conducted during the winter crop season of 1998 and 1999. Apart from fifteen farmers (persons in different circumstances) chosen based on non-random sampling in two selected communes of Trong Quan and Ha Hoi, the interview also involved sixty-five farmers in districts of Y Yen, Binh Luc, Chau Giang and Nam Thanh. The first interviews were conducted during September to December 1998, and repeated (with the same interviewees) in September to December 1999. In January and February 2000, the previous gathered information was re-checked by a visit to all fifteen selected farmers. In addition, the information gathered has been complemented with interviews with key informants in the commune and also in the district and province (other experienced farmers, commune and village leaders, and heads of mass organizations such as Farmers' Union, Youth League, Extension Service, etc.). With respect to TPS, the interview also involved researchers from VASI and RCRC. The interview of ten farmers who do not plant potatoes was also conducted to see why they were not interested in planting this crop.

The questionnaire aimed to assess socio-economic, agronomic and innovative aspects in the area in order to get a clear picture of the agro-ecosystem, decision-making and implementing actions in the process of winter potato production and TPS technology adoption. Efforts from research and extension to improve the seed supply system, and farmer behavior with respect to the new technology received special emphasis. Other aspects such as pest/disease management, sustainability of the new system, the operation of extension work, farmers' organization, processing and marketing the products, were also looked into. To evaluate farmers' behavior with respect to TPS, I also discussed with them their previous experiences in farming, their problems, needs and conditions for adopting the technology. The questionnaire was pre-tested and revised. Normally, the interview with farmer was followed by a visit to his or her farm. Joining to work with them is necessary because the farmers are very busy in this season. I also took the opportunity to discuss related topics with some groups of farmers. The farmer profile is presented in the previous chapter (Chapter 5). The detailed results used are given below.

## IV-Efforts by research and extension

### IV.1-On going botanical TPS research and production

In Vietnam, two Indian progenies HPS-2/67 and HPS-7/67 were named as *"Hong Ha-2"* and *"Hong Ha-7"*. Farmers in the RRD are already using these names as well established variety names, a sure sign of widespread acceptance of the TPS technology there. Hybrid progeny testing for the selection of promising new progenies for eventual recommendation and release to farmers,

is clearly of high significance if the existing results obtained with the two TPS hybrids *"Hong Ha-2"* and *"Hong Ha-7"* are considered. The success of the TPS technology in the past four years (1993-1996) has led to a new confidence among the farmers. Now researchers can provide them with new hybrids even more amenable to the needs of a rice-based cropping system where the potato has to fit exactly between two rice crops. This means that an even shorter maturation period as already evident in *"Hong Ha-2"* and *"Hong Ha-7"* would be highly welcome.

The mass production of TPS under Vietnamese conditions has started since 1996 when the needed parent material for the production of (botanical) hybrid TPS became available. The research on TPS had begun at the Da Lat Food Crops Research Center (DFCRC), a highland location in South of Vietnam, and on a private farm near the research station of the DFCRC. Another research location has been designed at VASI in Thanh Tri district of Hanoi and SaPa where new facilities for the production of (botanic) TPS had been constructed. The most important conclusion to be drawn from this experiment was the realization that TPS can be produced under the conditions of the RRD. In 1996, a private farmer in Da Lat with the assistance of researchers from VASI produced a little over two kilograms of TPS botanic seed[56]. The researchers and TPS producer feel that additional training is needed in order to address the overriding question of seed quality.

The first stage of TPS research and production in Vietnam has been a complete success, because it met the specific need of a whole region by offering an alternative seed system that was superior to the old and discredited system that relied on degenerated seeds of questionable origin. The new TPS-based seed system makes it possible to grow potatoes in about 100 days as a winter crop between two rice crops. Generally, this success resulted from the full support of the agricultural research and extension community in Vietnam and the political leadership of several provinces in the RRD. On the other hand, training conducted by highly motivated groups of provincial agricultural extension officers and VASI staff, and the assistance of scientists from CIP Regional Office are significant factors for the success of this program.

### IV.2-The TPS research and extension program

With the co-operation of research and extension institutions, a TPS program has been proposed as a project for the coming years. The project consists of three components as follows:

1. Diffusion of hybrid TPS technology;
2. Germ-plasm testing and seed multiplication; and
3. Mass production, certification and distribution of (botanic) TPS.

[56] This number was about 20-30 kg produced in 1999 according to the RCRC.

As mentioned in the project document, the first component "Diffusion of hybrid TPS technology" should receive considerable attention in the planning process. Farmer-to-farmer training has been shown to be a highly effective means of technology diffusion under conditions of the RRD because a large number of farmers are involved. The production and distribution of extension materials (folders, simple manuals, videos, etc.) and mass media communication plays an important role for the success of the activity. The second component is highlighted as a key factor for the long-term sustainability of the TPS technology in the region. Although *"Hong Ha-2"* and *"Hong Ha-7"* fulfill immediate agronomic requirements for most of the agro-ecology in the RRD, the need for new genetic combination that can produce a higher rate of tubers for processing at the first generation (Go) is considered as one of the most important goals of both researchers and farmers. All interviewed farmers answered that the solution to the seed tuber problems is the (botanic) seed that produces a ware crop from transplants without the need of tuber storage[57]. In addition, farmers also require progenies that mature in as little as 85 days after transplanting under conditions of rice-based farming in the RRD. The expansion of potato production to highland regions outside the RRD may need new genetic combinations.

On the other hand, the utilization of seedling tubers as healthy inexpensive planting material for multiplication after seeding transplant (i. e., G1 and G2 tubers) is a critical factor. In the RRD, those tubers have to be stored during the hot humid summer time for up to nine months. This aspect will therefore receive attention from research and extension.

The last issue in (botanic) TPS production is that of botanic seed quality, which requires special attention from researchers. Seed quality not only relates to production, but also to the handling, packaging, transportation and storage of seed so that it will not loose its viability.

The above discussion means that solutions to the seedling tuber problems remain a challenge to the research and extension program on promoting potato production in Vietnam, particularly in the RRD.

## V-The application of Hybrid TPS technology

The diffusion of TPS technology is initially organized in a national program, which involves a number of scientists working on this field and local extension workers in some different locations of the RRD. Since 1993 Ha Tay, Ha Nam, Hai Hung and Thai Binh have been chosen as four major provinces where this program is operating. The selected provinces represent different agro-ecological and socio-economic conditions for potato production in the region.

[57] Farmers hope that, in the near future research can provide them potato botanic seeds that they can sow in the nursery and then transplant young seedlings into the field with higher rate of ware potatoes (about 75-80 percent of total production). If so, the farmers do not have to store seed-tubers as TPS-driven (such as Go, G1 and G2) anymore.

The application of hybrid TPS technology in Thai Binh province is one of the successful cases (Table 20). Thai Binh province in the RRD has a total of 95,000 ha of arable land, of which at least 25,000 ha is suitable for potato production. The winter crop season often starts in late September or early October (after harvesting summer rice) and harvest time is late January or early February. The proportion of areas covered by winter crops in the two-rice crop fields is still low (about 33 percent). In the early 1980s, 15,200 ha were under potatoes, but this gradually reduced to 2,500 ha in 1995. The situation resulted from the unacceptable local cultivar for which high quality seed was not available (Son *et al.*, 1996). Potato is often planted later, from 20 October to 5 November, that means this crop does not affect summer rice yield much.

**Table 20 - Spread of the TPS in Thai Binh province between 1994-1997 and plan for winter 2000**

| Item | 1994 | 1995 | 1996 | 2000 (projected) |
|---|---|---|---|---|
| Amount of (botanic) TPS sown | 195 gram | 4.3kg | 20.5kg | 150kg |
| Area under transplants | 1.75ha | 42.2ha | 230.7ha | 1,500ha |
| Area under G1 and G2 tubers | | 21.9ha G1 | 461ha G1 & G2 | 15,500ha total area of TPS-derived material planted |

Source: Thu *et al.*, 1997.

Thai Binh now has become a major province for the adoption of hybrid TPS technology. In the winter of 1994, the hybrid TPS technology has been introduced and tested with the technical assistance from the RCRC. In January of 1997, the progress of hybrid TPS research and extension in Thai Binh was reviewed by a one-day national TPS workshop. The participants consisted of important Vietnamese institutions involved in potato research and extension.

Hundreds of hectares of potatoes, both from hybrid TPS or TPS-derived seedling tubers, were grown in the province. The TPS technology can play an important role in seed and ware potato production, replacing the local degenerated *Thuong Tin* in Thai Binh province.

**Table 21 - Amount of botanic TPS needed (in gram) to plant 1 hectare of potato crop in farmers' field**

| Year | 1993 | 1994 | 1995 | 1996 forward |
|---|---|---|---|---|
| Amount of TPS needed to plant 1ha of the crop | 270g | 149g | 120g | 75-100g |

Source: Ho *et al.*, 1996 and interviewed farmers.

One important element that has decisively contributed to the success of the TPS technology in Thai Binh province, as reported in the workshop, was a constant attention to the training of key farmers, particularly those who had been selected to raise seedlings in TPS nurseries. Between 1994-1996, a total of 3,121 farmers were trained with 46 training courses that were conducted all

over the province. Seedling nurseries were established in 351 households, and members of those households received training on more than one occasion. In 1995, more than 4,000 households were involved in the TPS Pilot Project. Table 21 demonstrates the results of careful training and farmers' experimentation with the new technology.

(Botanic) hybrid TPS is a highly valuable and highly priced commodity. None of the seed distributed was given away, and farmers paid up to the equivalent of 800 to 1,200 US$ for one kilogram of TPS. The National Root Crops program recovered almost 100 percent of the money spent on importing (botanic) TPS from India. The fact that botanic TPS is not free has motivated farmers to refine their nursery practices (not a challenge for experienced rice and vegetable farmers) and to reduce the botanic TPS needed for planting one hectare from 270 gram to 100 gram (75 gram in some cases) in three years (Table 21). A survey conduced by RCRC researchers in 1995-1996 shows that average tuber yield of hybrid TPS progenies in Thai Binh province was twice higher than local seeds, i.e., 23.6 tons/ha compared to 11.3 tons/ha of local seeds in winter 1995 (Ho *et al.*, 1996).

**Table 22 - Comparison of costs and benefits of potatoes grown from TPS, G1 tubers and clonal tubers (traditional seed) in the 1994 winter season**

| | TPS (Go) | | TPS (G1) | | Clonal tubers | |
|---|---|---|---|---|---|---|
| A-Inputs | '000VND/ha | % | '000VND/ha | % | '000VND/ha | % |
| 1. Seed(*) | 1,865 | 16.7 | 4,807 | 35.7 | 5,571 | 41.0 |
| 2. Fertilizer | 3,328 | 29.8 | 3,326 | 24.7 | 3,125 | 23.0 |
| 3. Pesticides | 503 | 4.5 | 242 | 1.8 | 231 | 1.7 |
| 4. Labor | 936 | 44.2 | 4,767 | 35.4 | 4,389 | 32.3 |
| 5. Others | 536 | 4.8 | 323 | 2.4 | 272 | 2.0 |
| **Total** | **11,167** | | **13,465** | | **13,588** | |
| B-Output | | | | | | |
| 1. Yield (ton/ha) | 12.4 | - | 18.3 | - | 12.3 | - |
| 2. Total value | 22,888 | - | 27,880 | - | 15,274 | - |
| 3. Large tubers | - | 29.4 | - | 54.7 | - | 35.5 |
| 4. Medium tubers: | - | 53.4 | - | 40.0 | - | 56.1 |
| ⇒ for seed | - | 51.8 | - | 33.1 | - | 27.2 |
| ⇒ for consumption | - | 1.6 | - | 6.9 | - | 28.9 |
| 5. Small tubers | - | 17.2 | - | 5.4 | - | 10.5 |
| ⇒ for seed | - | 15.3 | - | 1.7 | - | 2.3 |
| ⇒ for consumption | - | 1.9 | - | 3.7 | - | 8.2 |
| C-Net income | | | | | | |
| 1. Value | 11,721 | - | 14,415 | - | 1,687 | - |
| 2. Production costs | 940 | - | 760 | - | 1,160 | - |
| 3. Profit | 10,781 | - | 13,655 | - | 527 | - |

*Source*: Communal records. The data are averaged over 7 locations in the RRD.

A plan for the TPS-based production in Thai Binh has been made by the Agricultural Extension Center (provincial unit), which is based on those successful last few years. However, many issues in terms of weather and socio-economic conditions were not mentioned in the plan. In

fact, in the winter crop season 1997, the hot temperature heavily affected potato production and TPS-based plants did not grow as well as expected.

The successes of the production of the TPS-based potato in Thai Binh province have shown the high potential for the expansion of TPS-based production to other provinces of the region. However, in the practice, there are many problems that need the assistance from research and extension.

## VI-Does the farmer need hybrid TPS Technology?

### VI.1-The success of TPS-based production in Trong Quan commune and market problems

Trong Quan commune is located in the southwest of Dong Hung district, Thai Binh province. The land of the commune is 531 ha of which 388.48 ha cultivated (commune records in 1998). Trong Quan is seen as a commune with a good irrigation network: most of arable land in the commune is irrigated. The population in the commune is about 7,200, living in three small villages (Hung Quan, Vinh Quan and Trang Quan) containing 16 hamlets. Apart from the Farmers' Union (FU) and local VACVINA, the Agricultural Co-operative is still active and involves all farmers in the commune. In the commune there is a good communication network, including radio and local newspapers. This network among the farmers is able to develop the awareness of new technologies needed for their farming. In this area, winter crops such as maize, sweet potato, potato and vegetables have been planted in rice-based areas since 1965. Good irrigation allowed farmers in the commune to apply TPS technology in the winter 1995 in a large area (approximately 80 percent of the winter crops). Records from the commune show that under favorable conditions the farmers now can get 12.3 tons of rice together with 19.4 tons of potato per hectare per year (see Table 23).

In the past, as in other communes in Dong Hung district, the main cropping pattern in Trong Quan was applied as RICE-RICE-MAIZE. Since winter 1994, the commune has become one of the TPS Pilot Project's sites and the cropping pattern changed to RICE-RICE-POTATO (TPS) while farmers in other communes are still interested in planting winter maize. The proper planting time for maize is in the third week of September. Delayed planting or decrease in temperature as compared to the average can affect maize yield. A large area is still available for intensive maize cultivation in the region. However, to grow winter maize, the summer rice must be harvested within September. According to farmers, early harvesting can reduce rice yield by at least 10 percent when the best harvesting time for the high yield of rice is in the last week of October. In addition, the maize crop is usually harvested in February when the weather conditions are often cloudy and humid which make maize post-harvest handing more difficult. Hence, farmers only

grow maize crop mainly for their fresh consumption or for the need of animal feeds. The record from Trong Quan last few years indicated a right cropping pattern of Rice-Rice-Potato. Apart from technical aspects, the case shows that success of TPS-based production in the commune resulted from a good co-operation between extension workers and farmers. They have a close relation and worked together for a long time, with extension workers visiting the farmer regularly.

**Table 23 - Some crop production index of Trong Quan commune**

| Items | Unit | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| 1-Area: | | | | |
| Total arable land | ha | 388.48 | 388.48 | 388.48 |
| Of which: | | | | |
| -Spring rice crop | " | 380.00 | 360.00 | 358.00 |
| -Summer rice crop | " | 388.00 | 382.00 | 382.00 |
| -Other food crops: | " | 138.30 | 151.00 | 181.20 |
| Of which: | | | | |
| +Winter maize | " | 15.00 | 19.00 | 7.38 |
| +Winter sweet-potato | " | 15.00 | 20.00 | 13.38 |
| +Winter potato | " | 97.80 | 97.00 | 155.01 |
| +Others | " | 10.50 | 15.00 | 5.43 |
| 2-Yield: | | | | |
| -Spring rice crop | ton/ha | 6.65 | 6.83 | 7.47 |
| -Summer rice crop | " | 5.10 | 6.44 | 4.83 |
| -Other food crops: | | | | |
| +Winter maize | " | 3.30 | 3.00 | 3.00 |
| +Winter sweet-potato | " | 10.00 | 10.00 | 10.00 |
| +Winter potato | " | 12.00 | 13.80 | 19.40 |

Source: Commune records, 1997-1998

The information from the interview conducted in 1998 and repeated in 1999 also showed that farmers in the commune have made good progress of TPS-based production in the period of 1993-1997 (the average yield of potato from ten interviewed farmers reached 22 tons per hectare in the winter 1997). This can be explained as follows:

- Economic visibility: gross return from planting TPS-based is higher than other crops such as sweet-potato, maize and traditional varieties of potato per unit of area (770,000 VND/*sao* compared to 210,000 VND; 208,000 VND and 300,000VND respectively);
- Potato production in winter season meets the time demand of a stable cropping pattern Rice-Rice-Potato in which the field is available to winter crops from 20 October to early February;
- Good production skills resulting from good training on TPS, especially methods and techniques of doing TPS nursery.

There are some constraints of TPS-based production in the commune such as irrigation availability, soil quality, and fields that are far from the farmers' houses making the production management and protection more difficult. However, the risk was remarked. An example of the risk of potato production caused by unfavorable weather conditions in the RRD in 1997 affected

TPS-based producers. In that year, the potato yield in Trong Quan was estimated to be 50 percent lower than that of 1996.

The market for potato products has been one of the major concerns of the farmer. As mentioned above, most farmers in the RRD are self-sufficient food producers, and potato can be seen as a cash crop. The market of TPS-based potato is evaluated for different of products such as ware potato (G2), seed-tuber (G1), and seedlings (Go).

**Picture 12: Selling potato in Trong Quan commune**

In 1996, the total production of ware potato in Trong Quan commune was estimated to be about 1,500 tons. However, only 20 percent of these (about 300 tons) were sold at a good price in the market. The farmers found difficulties to sell the rest of it. In most cases, they have sold it at a lower price or used it for feeding animals, which was not the farmers' purpose[58]. The picture shows farmers waiting quite long time for selling their potatoes (Trong Quan commune, winter 1999).

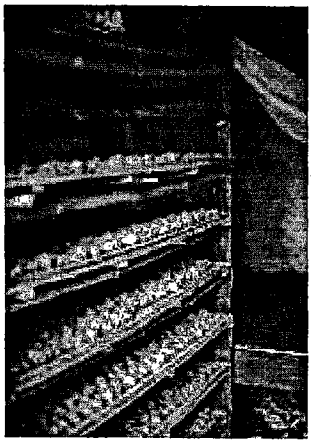
In practice, a potato nursery can give the farmer the highest benefit (in Trong Quan, there are 34 farmers doing potato nursery). In the winter season 1996, potato nurseries provided seedlings for planting 32 ha of farmers in other communes after satisfying the demand of producers in the commune. However, in 1997 season, the seedlings sold to other communes were 14.2 ha only because the competition from other supply sources.

### VI.2-Why are farmers in Ha Hoi commune standing outside the project?

Ha Hoi commune is located in Thuong Tin district of Ha Tay province. For a long time, the farmers in the commune have been growing seed potato as a commercial crop. Potato seed-tuber production in the winter has become an important source of income. Nowadays, Ha Hoi has become a famous commune producing seed potato in Vietnam.

In the commune, the local "*Ackersegen*" variety has been grown for a long time. As other farmers in the RRD, the seed potato producer is facing problems of low quality of seed-tubers that result in a low yield. The long time of storing results in high rate of loss. The seeds are often kept under conditions of diffused light storage in the farmers' house (see Picture 13).

[58] In all project sites, G1 potato production in 1999 is estimated to be about 5,000 tons of which only 200 tons can be sold and 300 tons stored by the farmers for seed for next season. RCRC, 1999.



**Picture 13: Storing potato-seeds inside farmers' house**

Almost all (100%) interviewed farmers said they knew the methods and techniques of TPS production through mass media. As experienced farmers, they understand the advantages from applying the technology as a potential solution for resolving problems of potato producers. There were farmers from the commune who attended seminars/workshops organized by the research station or visited a TPS-based demonstration in a farmer's field. At that time, they were shown how to benefit from TPS planting and learned how to do the practices. However, according to them, the Pilot Project is presently testing TPS and they decided to continue their own way of producing seed potatoes until a higher demand of TPS emerges.

Due to increasing household income and the development of storing technology, some richer farmers in the commune try to build their own cold store. This investment can resolve some problems in storing seed potatoes and, at this time, attract the farmers' attention more than the TPS technology. The seed to be stored is available from the commune and the price is cheaper than the TPS-based seed bought from other areas including the transportation costs. However, some of them have shown their interest in storing TPS-driven (for example, "Go"[59]) seed and they try to make full use of their cold store. The seed-tubers "Go" are collected from TPS project communes. Storing seed-tubers in cold storage opens a good opportunity for TPS producers', and storeowners can get more benefits than with the traditional system. In 1999, some farmers in Ha Hoi commune have got net benefits from storing TPS-driven G1 and G2 in their cold storage five times higher than from traditional way of seed-tuber storing. The owners will get more if they store "Go" for selling next season at higher price of seeds. The question is how well farmers in the Ha Hoi commune know about methods of TPS-based production. Why does extension not pay more attention to promote TPS in a commune where the farmer has been seen as famous in producing seed potato as in Ha Hoi? One interesting question is why the producers are still planting "*Ackersegen*", but not TPS.

In fact, the methods and techniques of the TPS-based production are not very different from those of traditional way of producing seed potatoes. The difference is only in the crop nursery techniques. However, for farmers in a commune like Ha Hoi, it is not difficult to learn and adopt this technology. Most interviewed farmers have shown their own experiences in crop nursery

[59] Go: original generation is from botanical seed

activities with cabbage, kohlrabi or other crops that these techniques can be easily adapted for growing TPS.

Although fetching a good price, the market demand for TPS-driven (Go, G1) seed-tubers is still lower than the local "*Ackersegen*" because only farmers who are aware of TPS come to ask for these seeds. At this time, botanic TPS can be produced inside the country and on-farm trials demonstrated that its quality is not lower than those imported from other countries. However, many producers think that the botanic TPS source is still dependent on few research stations and not available in the marketplace. In addition, the market for ware potato is not so good because Vietnamese people do not like to eat potatoes often. This prevents farmers from taking the initiative in TPS-based production.

Regarding to TPS, the supply agents in the RRD include research and extension agencies. They have permission to import seed or are producing botanic TPS. To some extent, they become monopolists in the seed supply system. Seed (tubers) and ware potato producers and also storeowners remain dependent on them. In this situation, another alternative is not available to the producers. No producers' organization means no contracts to be signed between the small producers and TPS sellers. Nothing is sure about the availability of the seed before planting time. Dependency on one source of seed supply and risks in marketing their products (even to ware production) are constraints, which make the producers reluctant to adopt the technology.

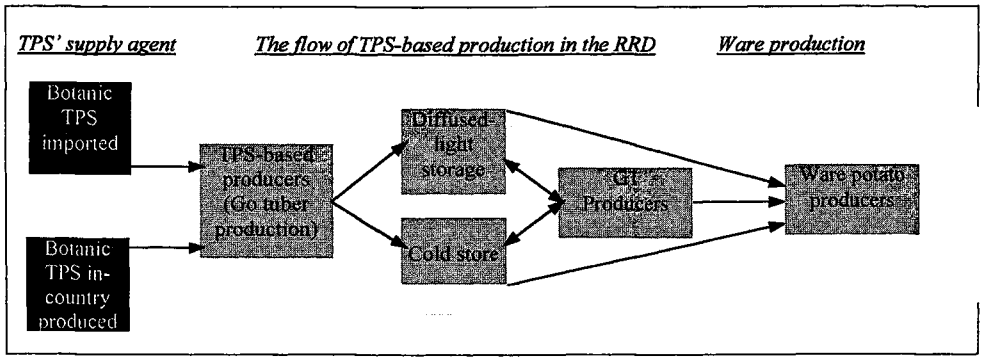



**Figure 6 - Seed supplying to TPS-based production in the RRD**

## VI.3-Choosing local "*Ackersegen*" or TPS?

The Ha Hoi case can explain why many farmers in the delta are still growing local *"Ackersegen"*. For most potato producers, the local *"Ackersegen"* (or Thuong Tin variety) is only a grudging acceptation when no alternative is available. Although there are successful cases on planting TPS-based, the TPS project now is still in a testing phase.

Regarding to technical and economic aspects, the research has shown many advantages from applying TPS technology in the region, but the TPS diffusion process is limited. According to interviewed farmers, they are still waiting for a realistic policy on TPS extension. It may not be necessarily to formulate a subsidy policy for this situation. The policy must help small producers overcome problems in the initiation stage and, even more important, in marketing potato products. Without being aware of new techniques and methods on TPS-based production, farmers could not be ensured by only hearing from outsiders.

One thing that should be realized is that although potato is seen as an important and valuable crop, the rice production is the most important consideration of the Vietnamese farmers whose families prefer to eat rice. Hence, the farmers are not potato producers only, but mainly rice producers. In a farmer' strategy, rice is in highest priority of their farming and potato, as a cash crop, is only one of their options. Choosing local *"Ackersegen"* or TPS for the potato production is not a critical issue to most farmers when the inputs needed for the new technology and market for the product are not always available. Farmers with small areas of land, of course, have small demands for the seed. It becomes more difficult to manage importing services for that demand, leading to high costs of delivering the seed to thousands of producers, and farmers are not always getting the seed at the right time.

*VI.3.1-Issues inside potato production and TPS technology*

One of the most important issues in the RRD is the population pressure. As mentioned in previous chapters, small farm size prevents the farmers in the RRD to test or adopt a new technology. This situation leads all actors to pay more attention to encouraging modern farming practices. In order to get enough food, farmers in the RRD are interested in getting higher productivity and enhancing the stability of their farming activities as much as possible.

*Productivity is farmers' purpose?*

In Thai Binh province, the expected productivity from the cropping pattern of Rice-Rice-TPS is about 13 tons of rice plus 18 tons of potato per hectare[60]. Till now, this is the highest index of productivity per unit of land in the RRD. This is based on those farmers in Trong Quan commune who already adopted TPS during the last few years. Many farmers in the province are interested in following the successful farmers in that commune. However, it is not easy to gain success like the case of Trong Quan commune. The case shows that is not only technical solutions of the farmers' problem that are required, but also attention to some social problems.

[60] Annual report on The Development of Agriculture in Thai Binh province, Mar. 1999.

Regarding to agro-ecology, records from VASI and RCRC show that farmers in different locations of the RRD can get the same high yield of potatoes as the farmers in Trong Quan commune by applying an improved cropping pattern and intensive farming. However, only some of them really have a good harvest. In my study, most interviewed farmers said that one of reasons is that they were not very familiar with new seed like TPS in the nursery stage and practical demonstrations were not available in their villages. All (100%) interviewed producers found it was very hard to sow a small amount of the botanical TPS themselves.

In order to get good quality plants; it was proposed that a seedbed should be made by one producer for transplanting into the field of about 25-30 farmers (the area approximates 1 hectare TPS-based production). This calls for a kind of farmers' organization (i.e., an interest group of farmers) to help small producers to get a high productivity from applying the technology. These groups of farmers share the seed and seedbed costs and exchange their experiences in planting potatoes. They can also help each other to get access to markets for their products, especially in producing Go when most of the products will be stored as seed-tubers for next season. Hence, farmers' groups can play an important role in ensuring high productivity of the TPS technology application. Together with training on TPS-based production techniques, more attention should be given to policies for promoting farmers' organizations. At present no study has been carried out to recommend ways to organize producers.

As mentioned above, farmers in rice-based farming areas in the RRD also are potato producers and consumers. In a farm, the small farm size and crop diversification (for family demands) makes the area for growing potatoes smaller (only a small part of farmers' fields is allocated for this purpose). The farmer tends to invest his scarce resources in farming activities that can give him a high income and that are as simple as possible. High productivity in a unit of land such as growing TPS may make the work more complex than traditional production. Only some farmers (for example, in My Tho and Trong Quan communes) can get a good harvest from TPS-based production individually. They are progressive farmers and have a good contact with research and extension workers. Most of them now became TPS-based producers who can sell seedling potatoes (young plants) to others inside and outside the commune. Thus, the concept of productivity in farmers' point of view is value or cash income per unit of area, but not simply crop productivity.

The data from Table 24 below show a very high benefit from one hectare of TPS seedling production in the winter. However, it was based on data from small samples and estimated for one hectare. In fact, the conditions on a very small nursery are completely different in terms of crop care and market availability.

**Table 24 - Costs and return analysis per hectare producing TPS seedlings in 1995**

Unit: cash in million VND[61]

| Item | Thuy Minh commune | | Trong Quan commune | | Quang Binh commune | | My Tho commune | |
|---|---|---|---|---|---|---|---|---|
| | Cash | % | Cash | % | Cash | % | Cash | % |
| **Total costs:** | **72.24** | **100** | **72.30** | **100** | **71.80** | **100** | **61.02** | **100** |
| 1. Seeds | 44.43 | 61.5 | 44.43 | 61.5 | 44.43 | 61.9 | 39.82 | 65.2 |
| 2. Chemical fertilizers & pest insecticides | 6.36 | 8.8 | 6.42 | 8.9 | 5.94 | 8.3 | 7.97 | 13.1 |
| 3. Equipment | 9.72 | 13.5 | 9.72 | 13.4 | 9.91 | 13.8 | 3.78 | 6.2 |
| 4. Labor | 6.80 | 9.4 | 6.80 | 9.4 | 6.61 | 9.2 | 5.86 | 9.6 |
| 5. Others | 4.92 | 6.8 | 4.93 | 6.8 | 4.90 | 6.8 | 3.59 | 5.9 |
| **Gross return** | **124.43** | | **123.44** | | **116.63** | | **95.57** | |
| **Net benefit** | **52.19** | | **51.14** | | **44.84** | | **34.55** | |

*Source*: Hue, T.T. 1996.

*Equitability from adopting TPS*

In general, the yield obtained from the application of TPS technology has been recorded as being 50-60% higher than traditional production in farmers' fields, and the production costs in a unit of land are 40% lower. In general, all farmers can use TPS technology equitable, however, we can see differences between two groups of farmers applying the technology as early and late adopters.

Looking back to the land reform policy in the RRD, the difference is not in farm size, but in their insight and knowledge resulting mainly from their levels of education. Farmers with a higher level of education often get access to technology information and become contact farmers easier than others (information from interviewing farmers and extension workers in Dong Hung, Binh Luc and Nam Thanh districts). In the Pilot Project, most farmers who attended the training course are those with a higher level of education in the project's communes. It is easy to see that farmers who undertake TPS technology benefit directly. Farmers with a lower level of education tend to be the late adopters and in most cases, they failed to get benefit from the technology. Their failures resulted partly from inability to be timely aware of required methods of production, especially TPS nursery techniques. So, the equitability of TPS technology can be firstly understood as a training problem. For a wider adoption of TPS in the RRD, keeping in mind equitability in applying TPS technology, the training program on TPS-based production should be improved and implemented on a large scale where producers can get access to it. This is not easy because of the

[61] VND: Vietnamese currency

large number of small farmers in the RRD who, as mentioned, are erratic potato producers and hence, not much interested in learning about this technology.

*Stability of the TPS*

Till now, we could not say that the TPS technology has become a stable one. As mentioned above, the technology is still in a testing phase. Although the technology has shown advantages, the failures are still around too. Almost all failures seem to stem from lack of training both in terms of seed supply, marketing and technical topics. As mentioned above, more training courses should be given for farmers who want to adopt TPS in their fields. In general, the farmer in the RRD can quickly become familiar with new techniques recommended with assistance from extension network. However, the extension services do not have enough resources to provide training to all farmers in the area.

Apart from physical conditions, attention should be paid to socio-economic aspects when implementing research and extension program on the TPS-based production. The stability of TPS adoption needs a good extension program in which training and formation of farmers' organizations play an important role. In this sense, we can see several successful cases in applying the technology, for instance in Trong Quan and Co Thanh communes, where farmers were organized in interest groups of producers. Well-trained and organized producers will contribute to making the yield of their crop higher and more stable.

*Sustainability implication for adoption of TPS*

A clean seed supply is maintained by planting disease-free botanical seed (TPS) and the growing a maximum of two generations of potatoes from TPS-driven tubers. In this manner, the incidence of major seed-borne diseases such as bacterial wilt and viruses is drastically reduced. The causal agent of bacterial wilt survives in the soil and potato tubers may be infected. Likewise, potato plants may be rapidly infected with viruses regardless of their origin. The advantage of TPS as a seed source is that seed-borne diseases can be continuously "flushed out" (Dinh, 1997).

In the past, seed potato was stored in the storage of agricultural co-operatives or state agencies. Pesticides were applied to prevent disease attack. Only a small amount of seed was stored in farmers' houses without pesticide. Hence, the impact of pesticide use on seed-tubers was easily controlled. After introduction of the new economic policy, the concentrated storage of co-operatives and state agencies does no longer exist, because most of the potato producers can store the seed for their own use (or for sale) in their house. The amount of pesticide used in storing seed-tubers inside farmers' house was not recorded. However, the producers have increased the quantity

of pesticide due to high level of pest and disease infection. Hence, storing seed potatoes inside their house may lead to a toxicity and pollution problem.

There is no record of the use of chemical pesticides in the farmer field. However, according to interviewed farmers, pesticide use in traditional potato cultivation in the RRD is low. In some cases, a trend towards higher use has already been noted among farmers who are growing TPS. Highly toxic organophosphates and banned products that are still obtainable, such as *Parathion*, are commonly applied. In the discussions with farmers utilizing TPS in Hai Hung and Nam Ha provinces, I found that they are using pesticides prophylactically, and that their knowledge of which products are effective against the pests and diseases that are present in the field is extremely limited.

In the first year, TPS-based production (Go) can not reduce the cost of using pesticide in the field (the farmer sprays the same amount of pesticide in the field as applied for other potato seeds), but no seed storage is needed. In large scale of potato production (for example around 30,000ha in the RRD), the amount of pesticide used will be considerably reduced. There only is a problem in the nursery when seedlings need to be protected against pests and disease attacks. The rate of pesticide used in this period is high, but only in the small area of the nursery where the farmer can easily manage it and this does not make a serious toxicity problem to them.

Information from interviewed farmers showed that they trade-off between productivity, stability, equitability and sustainability with more attentions given to productivity and equitability than stability and sustainability. Higher productivity per unit of land by applying the cropping pattern of two rice crops followed by winter potato (or other crops) may provide them more income. For most farmers in the RRD, the adoption of the TPS technology is applicable. However, for individual farmers, their decision on which crop should be grown in the winter season, which technology is to be used, is not so much considered because they are small (small arable land, small investment in terms of labor and capital, and small level of production). In this sense, the farmer can flexibly change his mind to shift to another solution if any condition for the first plan was not met.

*VI.3.2-Farmer's opinions about TPS*

During the time of my fieldwork, I had a chance to visit ten farmers who are producing TPS-based potatoes in Trong Quan commune (three of them are doing TPS nursery). I also visited other farmers in Ha Hoi commune (Thuong Tin district), My Tho (Binh Luc), Dong Tao (Chau Giang), and Thanh Xa (Nam Thanh), who produce seed potatoes in the traditional way or are not interested in potato production.

Considering winter production and their cropping patterns, most of them agreed that potato is one of the important winter crops from which they can get income as a cash crop. They said that in their case and that of their neighbors, potatoes are planted mostly for sale because they are not interested in eating them. Few people said that they eat potato simply because the product is available. Some part of the product could be used for feeding pigs, if the market was not good. After harvesting, many people sell potatoes because they don't want to keep the product longer as that may result in loss in terms of both physical appearance and price (it is difficult to sell potato in the summer season). In many cases of my visits, farmers said that they have changed to planting other crops such as vegetables in the winter season instead of potatoes.

About TPS, most of them felt that it is difficult to take advantage from this technology, because availability of the seed and the market is very uncertain. Some farmers said that TPS needs very complex guidance and this is a complex technology.

**Table 25 - The area of TPS-based production in communes surrounding Trong Quan, seasons 1997-1998**

| Names of communes | Area of TPS-based production (ha) |
|---|---|
| Dong Phu | 7.2 |
| Minh Chau | 5.4 |
| Phu Chau | 7.9 |
| Nguyen Xa | 9.7 |
| Dong Quang | 10.1 |
| Dong Duong | 1.8 |
| **Trong Quan** | **155.0** |

The case of Trong Quan has not been repeated in other communes with similar production conditions in the district (see Table 25). The reason is that farmers in that commune are doing the TPS Pilot Project and the local extension agency could not carry out tests of TPS in other places because of limited resources. The TPS-based production in the farmers' fields could not be successful without training and demonstration by extension. As many others in the RRD, farmers in the district (Dong Hung) feel that it is risky to choose TPS to plant in their fields, e.g., the seed is not available in time, and to market their products, especially "Go" is difficult. Hence, they try to keep the conventional way of farming from which they are able to get a stable production.

*VI.3.3-Policy implication*

As mentioned above, research and on-farm trials on potato production using hybrid true potato seed were carried out on a large scale in the RRD since 1993 until now. As indicated in the project document, the objective of the National TPS Technology Diffusion Program aims at producing low cost and high quality planting materials; partially replacing seed-tubers; preventing disease infection and seed degeneration; improving seed storability and potato yield. The Program

receives technical and financial assistance from the International Potato Center (CIP) and the Asian Development Bank (ADB).

Experiences from the program showed that TPS technology could be seen as one of the most promising solutions to overcome constraints in the expansion of potato production in the RRD. Starting from government objectives, e.g., food security for the RRD and from the strategy for promoting winter crop production, researchers proposed the pilot project for testing and adopting TPS technology in the region. The parameters gathered from the project persuaded government administrators to approve the next steps of the transfer of the technology.

After the land reform policy, almost all co-operatives changed their function into providing services and individual farmers do not have a chance to present their opinions. The approval that the government has given to cooperatives (and other agencies) to import seed-tubers from other countries, which was called treating symptoms 'situation solution', can be seen as contrary to efforts to promote TPS-based production. This government approval may reduce confidence of producers in the TPS technology development process, in which the participation of the farmer is more important.

In the past, dissemination of technologies was seen as a form of governmental subsidy based on the argument that researchers and extension workers were responsible for introducing new technologies to the farmers, because the latter are poor and the government wanted to implement the poverty alleviation program. Nowadays, the situation has changed. The farmers have understood that they are no longer to receive this kind of subsidy. However, the monopoly of some agencies in importing and producing (botanic) TPS and the state-handled TPS program can create confusion about the seed supply system. When the time for planting potato is urgent, how can the availability of the seed (botanic TPS) for the producer be ensured? The producer must find another way for planting potato or other crops in their field when they are not sure of a seed supply. Now, the question of who will play the role of a TPS supply agent is still debated. For research, the question is how to develop a botanic TPS that can give a higher rate of ware potato in the original generation (Go). The question for extension is how to make TPS-based potato production available for all producers before the crop season. There is a strong relationship between farmers, new technologies and the market for their products. A new technology such as TPS can be accepted by farmers because of its higher yielding potential, but easily refused where the market for both inputs and outputs is not available. Progressive farmers see TPS as a good instrument to increase income. But the late adopters think that they could not get as high an income as the progressive, because they are lacking of knowledge on production and marketing of their products. In addition, the increase of total potato production may lead to decline of the price of ware potatoes.

## VII-Conclusion

At first glance, the diversification of their production can be seen as a good strategy of the farmers in terms of food security. The farmers are producers, but also consumers. In the region, population growth leads to increasing demands for food. In the last years, although a good trend of comparison between population and economic growth is emerging in the delta, there are consumers who currently increase their consumption of animal products and fresh fruits and vegetables. Economic growth, especially in the rural areas of the RRD leads to new demands for home consumption. The expansion of winter crop production can be understood to have two purposes for the farmers in the region: (i) as a cash crop it can increase the household's income, and (ii) it can diversify food for family consumption. Hence, in the long run, the expansion of winter crop production must be incorporated into the development of food processing technology.

In the RRD, one of solutions for improving the farmers' income and so their living conditions is to try to make more returns to a unit of cultivated area. A third crop in the winter season can be seen as an important source of income. It is also clear that small farms are flexible in choosing alternatives for their winter crop season. In this season, apart from growing maize, sweet potato, vegetables, etc., the farmer can plant potato as a potential cash crop. However, planting potato in the region is now facing many problems of seed supply, marketing of the product and storing conditions. The above discussion shows that the TPS program can provide the farmer with high quality of seed, and improve their production practices in order to get higher crop productivity in comparison with the conventional way of production.

The Scientific and Technological Committee (consisting of members from MARD and MSTE) approved a research and extension project on improving botanic TPS production. Two resolutions were approved (2854/QD-QLCN signed on 17 December 1996, and 286NN-KHCN/QD on 24 February 1997). The resolutions considered the lack of availability in the market of good quality seed potatoes that is the most important constraint to potato production in the RRD. As mentioned above, all efforts to improve the seed supply system in recent years have mostly aimed at technical aspects of potato production.

The adoption of hybrid TPS technologies has more or less contributed to the expansion of the total marketable outputs of farm commodities in local markets since 1994. Households adopting the technology must acquaint themselves with marketing of their products, especially botanical seeds (Go) in the first year of adoption, but no one has been as important as the one who doing nursery. There, of course, they encounter many marketing problems with which they have not yet enough experience. Marketing of the TPS products becomes an important element to farmers, especially nursery gardeners. In fact, it is quite difficult to say that a good market demand for seed

potato is developing in the RRD. This calls for decisions from program managers to make a realistic policy for research and extension. As shown, many efforts are made to acquaint farmers with methods and techniques of TPS-based production, but less attention has been paid to solve the marketing problems.

Success of the program in some communes has shown that more attention should be given to the improvement of training in production techniques, the seed supply system and the marketing of the product. The preparation of the program for the period of 2001-2005 is also mostly based on technical aspects of TPS, which represent only few of the many issues that need to be addressed. The TPS program for 2001-2005 focuses on seed production inside the country. At present, the seed producers in Vietnam can only produce about 40-50 kilograms of botanical TPS in the year (2000). This amount is below the demand for seeds for at least 40-50,000 hectares annually in the region. In addition, as already been mentioned, the technical demand for TPS-based adoption is that the farmer needs improved botanical seeds that can provide a higher rate of ware products in the first sowing crop season (as "Go" product).

The successful cases of TPS-based adoption such as Trong Quan and some other communes in the last few years show that the farmers can handle a dynamic process and quickly adopt an innovation, but that they need more assistance from research and extension than they have received so far. Apart from technical aspects, for a wider adoption of TPS policy measures may need to:

- Make clear what is the role of research institutions and extension agencies at different levels in the TPS innovation process;
- Verify and improve the seed supply system in the region;
- Create opportunities for the (group of) producers to join the market place by promoting processing for diversification of the products, opening markets for the product in other regions inside and outside the country.

A good policy should focus on demonstrations and training to encourage the producer in the adoption of the technology. A mass movement for training TPS producers will be appropriate to promote the production of an important winter crop in the RRD.

However, together with increasing potato production in the RRD, it is necessary to seek for new market of the product because the limited use of potato in Vietnamese diet.

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**Chapter 8**
**THE IPM PROGRAM IN THE RED RIVER DELTA**
**- Difficult work for extension?**

Integrated Pest Management Farmer Field Schools (IPM FFS) are seen as one of the good formal education methods to improve farmers' knowledge on their crop production. The IPM program in rice is designed to support the government strategy based on enhancing food security and is therefore not very appropriate for satisfying farmers' needs in the RRD. The farmer needs cash income through many farming and non-farm activities. Expansion of cash crops in the winter and changing to a new farming system with the development of raised beds asks for a redesign of the IPM program.

## I-Abstract

**Picture 14: Rat problem in Hai Duong province**

For a long time, investment in agricultural extension has been based on the assumption that agricultural science generates technology, which extension agents transfer to farmers. In fact, many times we witness farmers who have developed knowledge, reinvented ideas brought from outside and integrated them actively into complex farming decisions (Röling & van de Fliert, 1998).

As we know, in the RRD, improving farm household income and ensuring food security is a major concern of the agricultural research and extension programs. Many attempts have been made to increase productivity. Crop intensification is one important part of research and extension activities in the region. Intensive farming has been accompanied by a rapid increase in the use of pesticides, because high yielding and modern varieties are often considered to be more vulnerable to damage from insect pests and diseases. However, pesticide overuse has caused resistance of pests, alarming levels of residue, and serious environmental contamination.

Experiences from the practice in Vietnam and in other countries have shown that applying separate methods of pest and disease control is not an effective way of crop protection. The objectives of crop protection are only achieved by implementing Integrated Pest Management (IPM). In this approach, improved farming practices, together with disease resistance of crop varieties, biological controls and if necessary the uses of chemical methods are applied.

This case looks at the policy making level with respect to the IPM program operating in the region over the last eight years to examine the responsiveness of the program from the point of view of the farmer. By examining the formulation of an IPM program on potato[62], the case can explain difficulties in making a good extension policy that fits farmers' demands with respect to crop protection. To meet this challenge, there is a need to focus policy-making activities more on the precise nature of specific pest problems of farmers and to specify carefully what is needed to resolve them. The case uses an interdisciplinary perspective, encompassing the political, social, and economic dimensions of pest problems, as well as their agronomic, ecological, and technological features.

## II-Introduction

### II.1-Crop protection in the country and RRD

Crop protection is seen as one of the important activities that were described in the government policy document (Decree No. 92/CP on 27 Nov. 1993, Regulations on Crop Protection, on the Management of Pesticides, on the Organization, Administration and Punishment of Pesticide uses, etc.). The network for crop protection in the region has been established for a long time with the presence of the Plant Protection Department (PPD) with its branches at provincial level and the National Institute for Plant Protection (NIPP) under the Ministry of Agriculture and Rural Development. In addition, there is the state-owned Pesticide Supply Company with its branches, which act as sub-companies in every province and its stations at district level.

During the last twenty years, the intensification of farming has made the damage caused by pest and disease attacks more serious. Research stations have developed many techniques of pest management for the use of farmers in practice. In the field, the individual farmer takes most decisions about pest and disease control.

Since the early 1990s, Vietnamese Government has participated in the FAO inter-country Program on Integrated Pest Management in rice in Southeast Asia, which is well known for its success in pest control, but also for disease control (e.g., variety trials in FFS in Quang Nam

[62] So far, there have been no potato FFS in the region.

province on disease resistance in 1995-96)[63]. For rice crop production, during 1992-1998, over 400,000 rice farmers graduated from 15,356 Farmer-Field-School (FFS), over 3,000 farmers were trained to conduct farmer-to-farmer FFS, and about 1,000 IPM clubs were established (FAO, Hanoi, 1999)[64].

As in other Asian countries, insect pests and diseases have been recognized as an important biological constraint to agricultural production, particularly in the RRD. Various changes in the use of crop varieties, as well as in cultivation practices (increased cropping seasons per year, high nitrogen dosages), have given rise to numerous problems with pest and disease control. In rice fields, apart from known pests and diseases, such as the brown plant hopper (BPH), stem borer (SB), rice blast, and sheath blight, some new diseases, such as bacterial black rot of grain, and leaf yellowing, have appeared. These are more complicated, and the known control measures are less effective.

**Table 26 - The list of major pests and diseases in rice and potato in the RRD (in common name)**

| *Rice* | *Potato* |
|---|---|
| 1. Dark head stem borer | 1. Broad mite (*Polyphagotarsonemus latus*); |
| 2. Striped stem borer | 2. Thrips (*Thrips spp.*); |
| 3. Yellow stem borer | 3. Cutworm (*Agrotis ypsilon*); |
| 4. Leaf folder | 4. Root aphid (*Rhopalosiphum rufiabdominalis*); |
| 5. Brown plant hopper | 5. Mealy bugs (*Pseudococcus citn*); |
| 6. Green leaf hopper | 6. Bacterial rots (*Pectobacterium carotovorum*); |
| 7. White backed plant hopper | 7. Bacterial wilt (*Pseudomonas solanacearum)* or its new name is *Ralstonia solanacearum*; |
| 8. Rice bugs | 8. Late blight (*Phytophthora infestans*) |
| 9. Rice blast | |
| 10. Sheath blight | |
| 11. Bacterial leaf blight | |
| 12. Bacterial grain rot | |

*Source: National Institute for Plant Protection & Hanoi Agricultural University, 1997.*

For rice production, in order to control pests and diseases, some measures have been recommended for application of different measure or combination of them:

* the use of resistant varieties;
* proper cultivation practices;
* chemical application; and
* biological controls (FAO Hanoi, 1999).

The success in applying these methods in the last ten years has contributed to increasing rice yields and farmers' incomes (reduced production costs). In accordance with this, the improvement of production practices is seen as one of important avenues to development that fit current conditions and the abilities of the farmer in the region. Other measures have shown their

[63] FAO Community IPM Program (http//www.comunityipm.org/)
[64] Project Profile: CIPM, GCP/RAS/172/NOR, Phase IV: 1998-2002. FAO Hanoi, 1999.

limitations in terms of economic and technical performance or their availability during the best time of application. Cultivation practices are understood as the correctly timed planting of rice, the use of optimal dosages and concentration of NPK fertilizers, and the efficient management of irrigation water. However, in order to satisfy requirements of this method, on-farm trials need to be conducted for the training of farmers in efficient cultivation practices.

Chemical controls against pests and diseases have been used quite widely in the RRD. According to NIPP (1999), 109 pesticides have been registered for use in Vietnam, including 53 insecticides, 31 fungicides, 21 herbicides, and 2 rodenticides. The amount of pesticides used each year has varied according to the occurrence of pests and diseases. In recent years, the approximate amount used has been varied from 20,000 to 25,000 tons, with about 2,000 to 3,000 tons of active ingredients. The amount of active ingredient per hectare is about 0.5kg. The cost of pesticide imported is about US$ 20 - 25 million annually. A survey in ten provinces of the RRD conducted by scientists from NIPP in the period 1993-96 shows that the number of sprays for each crop season varied greatly for different crops:

| | |
|---|---|
| Rice: | 2 to 4 sprays/crop season |
| Potatoes | 3 |
| Vegetables | 4 to 8 |
| Summer soybean | 4 to 8 |
| Maize | 1 to 2 |

Vegetables, potatoes (in winter) and summer soybeans are seen as promising cash crops, and future expansion of their growing areas would involve increased use of pesticides in the region. At present, two state-owned companies are responsible for pesticide supply in the RRD: the Vietnam Pesticide Company (Ministry of Heavy Industries) and the Pesticide Supply Company (under MARD). The private sector now plays an important role in the distribution of pesticides.

After the agrarian reform of the late 1980s, the Vietnamese government became increasingly interested in renewing the role of its plant protection and extension agencies, and in handing over more responsibility to farmers. It wished to cut down subsidies on such agricultural inputs as pesticides and fertilizers. The IPM training program and Farmer Field Schools (FFSs), where farmers re-discover the agro-ecosystem of their fields, have been introduced in Vietnam on a national scale since 1992. This approval is based on the facilitating of learning by farmers.

In order to facilitate IPM programs, scientists from NIPP have proposed a (technical) research project that can generate the needed information for providing technical measures only:

- Resistance of insect pests, particularly vegetable, soybean and potato pests, to insecticides. This has led to increased pesticide use in the production of vegetables and summer soybean;
- The changes to bio-types and physiological characteristics of pests and diseases, resulting in the breakdown of the ability of rice producers to resist BPH and rice blast;
- Identification of newly occurring of pests and diseases, such as leaf yellowing and black grain rot in rice;
- Production technology for, and implementation of, biological agents, particularly natural enemies;
- Proper use of chemicals and reduction in the number of sprays, increased use of selective and less toxic pesticides, indication of base chemical application on forecasting notices.

### II.2-Chemical use and IPM/FFS in the RRD

The amount of chemical fertilizers used in agriculture of the RRD is still low in comparison with the demand, given that Vietnamese current uses 63.2% of the average use of NPK per hectare in South-east Asia or one third of that in developed countries (NIPP, 1999). Up to now, we do not have enough data to indicate the pollution/toxic index in the RRD caused by using fertilizers. Although many efforts have been made to introduce new varieties and FFSs in the RRD, farmers see pesticides as the main way to protect crops. The amount of pesticide used for vegetables is higher than for other crops grown in the area. The prediction of NIPP in 1999 shows that in the near future, chemical input use in agriculture is highly as follows: Urea 409,304 tons, Phosphate 570,368 tons, Kali 128,600 tons and pesticide 8,810 tons per year. Average chemical fertilizer use (material) is more than 200kg per hectare, and pesticide is about 1.4-2kg a.i. per hectare (compared to 0.5-0.7kg a.i/ha today). (The statistical data on chemical uses in rice in the RRD is not available, but information from the interviews in different research and extension institutions shows that this number tend to be considerably reduced in the last years).

Although the ideas of IPM are generally accepted in the political and scientific arena, policies and structures for implementing the program in practice have proved far more difficult to realize. So far in the RRD, the program has been introduced mainly in rice and only in limited areas for other crops (FAO, 1999). Regarding winter crop production, some IPM activities are being implemented in the RRD. For instance, FFSs on potato and vegetables production were organized by some research and extension agencies during the last two years. However, these activities are still dispersed, not well organized and only in limited areas of the region. For vegetables, data from FAO indicated that in whole country 14,526 farmers were trained in 538 FFS in cabbage, tomatoes and beans production (in the RRD, these courses have been organized in Hanoi, Ha Tay, Hung

Yen, Hai Duong and Hai Phong). Some 95 soybean FFS, 35 peanut FFS and 32 tea FFS have been organized in different provinces in the country (FAO, 1999).

The FFS approach was originally developed as an extension methodology for IPM in rice. This methodology is based on a structured learning process. The approach allows farmers to explore areas of knowledge that are of particular interest and importance to them. Today, this training approach is not limited to IPM in rice. In Vietnam, many NGOs, Government and farmers' organizations are trying to adapt and interpret it to suit their own specific situations and interest. Some these organizations are trying to apply the FFS approach to other crops like vegetables, sweet potatoes[65] and potatoes.

An interesting question for further research concerns the institutional arrangement, including farmer organizations and financial structures that allow the type of decentralized and participatory facilitation and policies. The most important question is whether introducing more sustainable forms of agriculture indeed require a different approach to extension as the IPM experience suggests? How can IPM curriculum for rice be adapted to other crops? With the land tenure system in the RRD, effective use of IPM is not an individual decision, but a collective decision of all farmers who have fields in a certain area.

## III-Materials and methods

### III.1-Study site

In the RRD, the situation with respect to crop protection and the IPM program is about the same as in other provinces. Due to the selection of study sites for the interviews on the new farming systems and TPS-based production, all sites of Thai Binh, Ha Nam, Hai Duong, Hung Yen, Ha Tay and Nam Dinh provinces were chosen for the IPM case. In these areas, the IPM program has been operating with support from International Potato Center (CIP), FAO and MARD. The implementing institution is the National Institute for Plant Protection (NIPP) with the cooperation of the Plant Protection Department (PPD) and its branches as sub-PPDs in every province. Because of the operation of IPM program activities in my study sites, a separate selection for this case is unnecessarily.

### III.2-The interview

The interview was conducted during the period of my fieldwork from 1998 to April 2000. The interview involved a total of eighty farmers, five researchers, ten officers of PPD and sub-

[65] National IPM Program with supports from CIP and FAO have conducted the Pilot Sweet Potato IPM FFSs and Field Studies in some provinces of Vietnam such as Bac Giang, Thanh Hoa, Quang Nam and Vinh Long in the winter season 1999. Now, they are trying to initiate the IPM FFS program in potato in coming years.

PPDs, and six district/provincial extension workers. The first interview was conducted in April 1998 and the last was in April 2000. In addition, the information has been complemented by discussion with local authorities such as commune and village leaders, and heads of mass organizations such as Farmers' Union, Women Union, Youth League, etc., in all visited communes.

The questionnaire aimed to assess socio-economic, agronomic and pest management aspects. Efforts from research and extension and farmers' behavior in the existing IPM program received special attention. Other aspects of farmers' innovation in pest/disease management were also examined. A semi-structured questionnaire was used during the interview. For interviewing farmers, questions included their assessment of pest infestation and damage, the actual pests treated, time and the frequency of pesticide use and some economic indicators such as crop yields and expenditures for agrochemicals. Normally, the interview with farmers was followed by a visit to his or her farm. The gathered information was analyzed and integrated as qualitative statements. The farmer profile is presented in a previous chapter (Chapter 5). The detailed procedures used are given below.

## IV-Attempts to introduce IPM program to other crop production

### IV.1-Potato production and pest attacks

As recorded earlier, during recent years, the farmers in the RRD achieved food self-sufficiency by intensifying the agricultural system to produce three crops per year. However, unfavorable climatic conditions and increasing damage from pest and disease attacks restrict considerably the potential for intensification in the region. Due to long experiences with rice production and with the operation of the IPM program, about sixty percent of interviewed farmers (49/80) now are showing proficiency in pest management and other production techniques in rice production. However, they are less aware of the solution for other crops such as vegetables, sweet potato, potato and fruit-trees. Since many of these other crops are grown as a third crop in the rice fields, neglect of pesticide use in the other crops also affects the sustainability of rice production.

According to researchers from the Hanoi Agricultural University (HAU) and the Root Crops Research Center (RCRC), key pests of potato in the RRD are broad mite attacks of the shoots and leaves, leading to bronzing leaf curling and stunting and shoot death. Interviewed farmers realized that the broad mite is barely visible to the naked eye, but they are not aware that the damage caused is related to the presence of a pest. Thrips cause plant stunting and deformation. Cutworms decapitate seedlings in nurseries and young plants in the field. The root aphid causes wilting and stunting. Seed potato (whether derived from TPS Go or G1, or from traditional local varieties) are stored for nine months from harvest in January to subsequent planting in November.

Ware potatoes are stored until they are used as food. The mealybug usually infests seeds and ware potatoes in home storage. Scientists at the RCRC have estimated yield losses due to potato insect pests varying from 20-30 percent. Thrips and mites are the most serious of these pests, causing yield reductions of up to 50 percent. They can cause crop failure if they attack TPS seedlings.

The leafminer fly named *Liriomyza sp.* has been recently identified in the RRD. This new pest, which attacks many vegetable crops, causes large losses in Indonesia, and threatens to become a key pest in the RRD of Vietnam (Ho, 1996). *Rhizoctonia* and bacterial rots (*Pectobacterium carotovorum*) have received attention from research institutes.

Pesticide use in traditional potato cultivation in the RRD is recognized as low, however the trend towards higher use has already been noted among farmers who are growing TPS-based potatoes (information from interviewed farmers and researchers). Discussions with farmers growing TPS-based potatoes in Hai Duong, Hung Yen, Ha Nam and Nam Dinh provinces indicate that they are using pesticides *prophylactically*, and that their knowledge of which products are effective against different pests present in their fields is extremely limited. According to them, the TPS growers see pests as a major factor limiting the TPS technology. All interviewed farmers are aware that pesticides are not effective in controlling thrips and mites, and they place a high priority on the development and implementation of effective pest management.

## IV.2-The "transfer" of system of IPM FFS principles

In general terms, the goal of the IPM FFS is "transfer"[66] of a system of principles and decision-making tools rather than the transfer of technology per se. The best results have been obtained when farmers actively participated in all phases of an IPM program, including its development. The IPM FFSs aim to improve farmers' understanding of the biological and ecological mechanisms that determine how and why pest damage occurs. Successful programs generally combine a number of key characteristics as follows.

Firstly, the information presented is based on sound knowledge of the biology and ecology of pests and of their natural enemies. This applies the existence of an adequate technical base upon which to build the FFS program. During the fieldwork, I found that for potato crop, all interviewed farmers are not very familiar with the pests (for instance, thrips and mites) and their natural enemies, as they are about rice pests. The potato producers realized that they are lacking this knowledge because they face the problem of pest attacks in their field only in the winter season. "For rice problems, we face pests twice in the year; but for potato, we have nine months to forget

[66] I bracket the term "transfer" that contradicts the nature of the FFS. "Transfer" implies 'top-down' while FFS provides opportunities for farmers to generate knowledge and acquire skills, being in charge themselves to determine what they want to learn (discovery learning).

them"- as some farmers said. This may make the IPM program on potato more difficult. In addition, interviewed researchers from VASI and RCRC also recognized that required knowledge on leafminer fly (*Liriomyza sp.*), *Rhizoctonia* and bacterial rot (*Pectobacterium carotovorum)* are not available to them yet.

Secondly, a training curriculum for the FFS contains field exercises that improve farmers' capacity as observers of biological and ecological processes. The field exercises must also develop farmers' ability to extrapolate management decisions from field observations on the status of the crop and its environment, its pests and diseases, and their natural controls. However, in the winter season the farmers are often very busy with various activities such as planting vegetables, fishing (harvesting fish in their ponds), preparing land for next crop season, weddings, New Year festival, etc. In addition, it is not fixed which family member is responsible for planting/caring for the crop. The development of the training curriculum must pay attention to this issue. The short duration of potato planting and changeable decisions of the farmer on which crop will be planted in the winter season[67] are also constraints of the program.

Thirdly, the IPM facilitators (trainers) are well prepared to conduct field schools and carefully selected for certain qualities as educators. They are highly familiar with the crop and with the community participating in training, and able to establish rapport with farmers. They are able to encourage hands-on learning by farmers and to provoke participants to ask questions and make observations for themselves. Field schools which are conducted by trainers who lecture to participants, utilize highly technical rather than locally understood terminology, or provide recipes for pest management generally do not succeed in improving the capacity of farmers as decision-makers and managers of agro-ecosystems. As mentioned, the duration between two potato crop seasons is long: nine months. The participant may forget what they have learnt from previous season. In areas of my interview, educators/facilitators for the IPM program on potato (and also on other crops except rice) are not available or not well trained[68] (see also: Workshop Reports, Hanoi 2000).

One of the most important rules is that the IPM program sees farmers as experts who have many valuable experiences in cultivation. This requires a high level of farmers' participation in all program activities. In the region, the participatory approach in implementing the program has been recognized and applied, but it seems to be new for the facilitators and also for the participants. Therefore, the level of participation is often low. Conventional teaching methods somehow persist

[67] During my interview, 12 of 40 potato producers answered that they changed to other crops or reduced considerably areas of potato planting in the winter 1998 and 1999. Four of them said that the seed was not available or more expensive at that time, five found other alternatives of vegetables and three felt there is too much risk in marketing the product.
[68] In the Sweet Potato IPM FFS Evaluation and Planning Workshop, Hanoi, Vietnam, 10-13 October 2000, the reports from different sites show that trainers often lack basis knowledge of sweet potato production.

and interfere with the methodology of IPM programs (see also: Workshop Report, Hanoi 2000). The participatory approach is only strictly applied when programs are operated and supervised by staff members from NGO or the IPM Country Training Program. I could not see any strong attention given to this approach from the state agency.

In the recent years, the Vietnamese's National IPM Program has expanded efforts to some secondary and horticultural crops. However, less attention has been paid to the development of the IPM program for root and tuber crops (potato, sweet-potato, cassava), although such an effort would particularly benefit rural households in the RRD, where the land available is very limited and the high productivity of root crops is an important advantage.

**Box 5: Profile of activities conducted in Farmer Field Schools in the RRD**

**Farmer Field Schools** *meet once a week throughout the growing season. Each session lasts for several hours. Most activities are conducted directly in the field. The community hosting the school, or the participants themselves, often decides to provide a pair of fields for use by the field school. In this way, they can apply their current crop and pest management practices on one field, and compare them to a second field where they apply management decisions taken in the field school.*

**Field observation**: *Participating farmers work in small groups to examine the crop. They evaluate pests, diseases, natural enemies, and crop status.*

**Agro-ecosystem analysis**: *The groups make drawings of what they have found in the field. The drawings depict plants, pests, diseases, natural enemies, and environmental conditions. Each group summarizes its findings and recommends crop management tasks to be taken during the coming week.*

**Presentation and discussion**: *Each group presents its drawings to the whole field school. Observations and analyses are discussed and participants reach a consensus about what, if any, pest/crop management tasks are required.*

**Group dynamics exercise**: *This activity is included in order to enliven the school, strengthen group cohesiveness, and encourage participation of all members.*

**Special topic**: *Experiments, lessons, exercises, and discussions revolving around a topic or problem of particular interest to the field school at the moment. The special topic represents an opportunity for the field school facilitator to introduce new information and to stimulate participants to explore the topic themselves, through hand-on activity.*

In 1996, HAU, RCRC and other research organizations in Vietnam have conducted studies on the biology, ecology and management of all of the key potato pests, with the exception of thrips. According to scientists, although some research gaps still exist, enough technical information is available to be able to initiate the process of FFS curriculum development (research on thrips has been given a high priority at HAU and RCRC).

In order to develop an IPM model suitable for root crops, the HAU in a cooperation with CIP has firstly established the pilot FFS for sweet-potato in some villages surrounding Hanoi city and Nam Dinh province. The rice FFS model (see Box 5) was used as a starting point and a curriculum covering eight basic topics has been developed. A training course on sweet potato for IPM field school facilitators (trainers) has also been conducted by HAU[69]. The field schools were conducted in tandem with participatory technology development activities that involved farmers in testing and evaluating practices and other pest management tactics. According to the researcher from HAU, lessons learned from these experiences can be applied to the development of FFS and to participatory technology development activities for crop and pest management in the RRD communities where potatoes are produced. However, although they actively participated in the project, all interviewed farmers found of hard to adapt what they have learnt to the potato crop. Up to now, no more activities have been carried out after those efforts, except for the Pilot Sweet Potato IPM FFSs and Field Studies conducted in four provinces in the winter 1999 and spring 2000 with supports from FAO and CIP (Kim, 2000). The curriculum applying to potato has not yet been developed.

There are also four basic principles that are central to the current participatory of IPM program applied in the RRD:

1. Grow a healthy crop;
2. Conserve natural enemies;
3. Monitor crops and environment routinely; and
4. Farmers are experts.

I can make the following remarks on the development of the training curriculum for potato:

The first principle (grow a healthy crop) refers to the emphasis on a role of good crop management as a fundamental part of IPM. The use of well adapted, resistant varieties grown under adequate fertilization and irrigation, sanitation and appropriate cultivating practices receive considerable attention in FFS training. Potato cultivation, of course, is not sustainable without a healthy seed. In a potato IPM program, the researchers have proposed that TPS should be treated as a component of IPM because of its role in reducing the impact of late blight, bacterial wilt and viruses, the principal diseases of potato.

Natural enemies are predators, parasites and microorganisms that kill insect pests. The conservation of natural enemies refers to avoidance of pesticide use whenever possible, and to the use of cultivation practices that encourage the survival, proliferation and effectiveness of natural

[69] The National IPM Program with supports from FAO and CIP has conducted Sweet Potato IPM FFS in the winter 1999 and spring 2000 in four provinces of Bac Giang, Thanh Hoa, Quang Nam and Vinh Long (Kim Groeneweg, 2000).

enemies. Sometimes appropriate introduction of exotic natural enemies may also play a role. In the case of potato production, the interviewed farmers and also the researchers said that they are unfamiliar with insect life cycles such as thrips, mites, etc., and unaware of the existence of natural enemies. One of important activities of the FFS for potato in the region is to familiarize farmers with these concepts and to train them to recognize and distinguish between beneficial and pest organisms.

Many pests have rapid population growth rates and a common reason for the failure of pest management tactics is that they may be applied too late to be effective. Decision-making for pest management requires detailed knowledge on the status of the crop and the balance between harmful organisms and their natural mortality agents. Therefore, developing the habit of regular and frequent monitoring of the field of small-scale producers in the RRD (in my study sites, no farmer monitored regularly in the past) is a prerequisite for the successful practice of a potato IPM program.

One of the most important objectives of IPM program is to combine the theoretical insights and technical power of the scientific method with farmers' knowledge, observation and practices. Experiences obtained from rice-based IPM programs showed that local crops and pest practices are the starting point for the development of IPM. Increasing their confidence in farmers' own powers of observation and analysis is a key goal of FFS training. The Vietnamese economy is in the transition from a system where decision-making in the rural areas was concentrated in the hands of cooperative leaders who responded to directives from their superiors and the district, provincial and national levels, to a system where the household is the principal economic unit, and although the communal structure or sometimes cooperatives particularly in the North still remains, the influence of this hierarchical system is waning. In addition, collective decision making for neighboring fields in term of crop protection by individual farmers is absent. Although more than ten years have elapsed since the introduction of new economic reforms, I found that (based on information from interviewed people) these changes occur slowly and farmers are still self-effacing and very differential to local leaders. This long-standing tradition of viewing those higher in the hierarchy as the experts means that Vietnamese IPM program faces the challenge of reinforcing the notion of their own expertise among farmers.

Another issue that is related to the success of an IPM program is gender. My interview of eighty farmers (as well as findings of Agricultural Economic Institute in the survey 1994-95) indicated that women generally determine the choice of crop and provide most of the labor required. But their husbands often take decisions regarding to crop and pest management. The dichotomy between labor and management presents a challenge in designing a curriculum for IPM

FFS training. This requires more precise information on household dynamics and its implications for training, technology adoption and diffusion.

The adoption of TPS-based together with an IPM program will hopefully resolve the long-standing problem of seed supply, improve family welfare, increase knowledge and enhance food security. The potential for expansion of TPS-based potato production depends on many technical and institutional factors, on the agricultural policy environment, and on the future demand for the crop. This in turn depends on the characteristics and growth potential of local and accessible urban markets, and on the potential for export.

## V- IPM program at village and farm level

### V.1-Farmers and IPM club

The initiation of IPM program on rice production has been welcome with the participation of thousands of farmers in the region during period of 1992-1999 (DAFE, 1999; FAO, 1999). They are very happy with having participated in the program that assists them to improve their knowledge on crop production. For rice, the IPM program at the commune and village levels is now trying to establish IPM clubs where group of about 20-25 farmers will monthly meet to discuss and exchange their experiences with rice crop protection. IPM clubs have also been established in the RRD[70]. According to information from interviewing provincial PPD staff in six provinces, the number of these clubs reduced in last year because of lack of intensive support from the state (no figure mentioned).

I have seen IPM clubs established with support from PLAN International Vietnam (NGO) in some villages of Nam Dinh and Ha Nam provinces. These clubs were formed after the implementation of the IPM FFS project funded by PLAN and implemented by the Provincial Plant Protection Department (PPD). With respect to the operation of the club, some club members said that they do not know what they should do. Trained farmers who attended previous IPM FFS said that they are not self-confident enough to implement their assigned activities. Moreover, they have the impression that their followers do not strongly believe what they said to them. According to them, farmers often like to listen to outsiders rather than their neighbors. In addition, these farmers said that, in their communes, IPM for other crops might absorb more of the farmers' attention than on rice crop production (see also Walczak, 2000).

In an IPM club, members are often experienced farmers who have already good production skills and know quite well about how to protect their rice crop. All interviewed farmers show their

[70] FAO Hanoi, 1999 reported that there 1,000 IPM clubs were established in the country, but not mention number of clubs in the RRD.

interest in resolving the problem of crop/plant protection for other crops such as maize, potato, vegetables, etc., and fruit trees. Discussion on rice production in the IPM club is not an interesting topic for them anymore. In some communes, the club managed by the Youth League is still operating well where young farmers are involved. However, it has become boring with its repetition in terms of topics they already know, and for the same crop, as rice. They said that updated information on rice crop protection is often introduced by mass media such as radio and TV, which are available now. The young people with better education levels can learn easily and quickly.

The discussion with farmers during my interview in other districts also shows that they are interested in learning about other crops, especially cash crops. In the area with a new farming system as in Nam Thanh district, the farmers are very interested in the protection of fruit trees and also other topics of cash crops and aquaculture (see also Chapter 5).

## V.2-Issues around the new land-use system regarding the IPM program

As mentioned, there was not any recommendation for the protection of fruit trees such as litchi in the areas of new farming system in the RRD. In Nam Thanh district, the farmers recognized that their litchi plants have been attacked by some kinds of pests and diseases, but the damage was not estimated and recorded. For litchi, the farmer said, those pests and diseases are not new, but they do not know how to control them. They named some kinds of stinkbugs and fruit-worms as main pests.

One of major problems is bat attack of maturing litchi fruits. The damage is recognized to be considerable[71], and estimated to involve a loss of about fifteen to twenty percent of litchi harvest in 1999 (interviewed farmers). All of the forty farmers interviewed said that this is one of the serious problems for litchi growers, but they do not know how to protect their fruits. During the time of my fieldwork, I have seen some farmers trying to protect litchi fruits against bat attacks by spreading bird nets to cover the fruit during the time of maturing stage. It is costly and the result was limited.

Another problem is the drop of green fruits. The farmers do not know exactly what causes it. They thought that their fruit trees might be affected by unfavorable weather conditions in the flowering stage and they try to treat them by using some kinds of *copper sulfate*. According to forty farmers interviewed in Thanh Xa commune, they often spray copper sulfate at least three times during this period. Most of litchi growers using this chemical are not sure whether it is the right solution. This problem can also be seen in the case of stinkbug and fruit-worm attacks. In most

[71] The litchi and longan growers in Luc Ngan and other districts are also facing this problem.

cases, the farmers lack knowledge both on their plants, pests and methods of the treatment. The research findings on these issues are very limited or are not available yet.

As mentioned in Chapter 6, the change of land-use system caused some problems of water pollution in fishponds. The appearance of diseases and dead fish during the first half of 2000 shows that the system needs to be re-designed. Today, this problem is threatening the development of fish raising activities in the area. There are no extension subject matter specialists who have as one of their tasks to inform researchers about problems farmers face in their field of specialization. The interviewed farmers do not know whether the fish have been affected by the use of insecticides in this area.

## VI-Policy implication

In most of documents about projects/programs financed by the government, while emphasizing crop diversification, food security is mentioned as a very important strategy without clear explanation on what it is[72]. The expansion of winter crop production through TPS (Chapter 7) and the VAC model (Chapter 6) certainly requires the development of technologies that farmers are lacking. In the delta, where many farmers get yields of more than 10 tons of rice per hectare per year, but since market demand for agricultural products other than rice is high, the farmers are more interested in growing other crops than rice or in raising animals.

The focus of IPM program on rice in the RRD is not in the interest of farmers who want to improve their knowledge on the production of other crops. However, the introduction of IPM to other crops is still restricted in the region. This is seemingly not very clear in government policies for the development of agriculture in the RRD. During recent years, attempts to introduce IPM in other crops such as vegetables, sweet-potato, and fruit-trees is limited because of lack of assistance from research and extension and the necessary support from the government. In addition, farmers' knowledge in the field of other crops and trees is not well known. Also, extension workers need to learn more about production technologies for these crops. In the region, there are very few extension workers with knowledge about fruit production or fish raising.

Farmers' innovation in the field of pest management of winter (cash) crops or VAC models is still limited. In Chapter 7 we found that the wider adoption of new technologies, such as TPS, requires careful training and organization of farmers. Once again we see the need for training on topics of production of value crops and pest management, and of farmers' organization. As they need income from planting cash crops and switch to new farming systems, improvement of

[72] Discussion in the seminar organized by FAO and National Institute of Nutrition in Hanoi Sep. 1999 saw Food Security consists of three components as food *availability, stability* and *accessibility.*

farmers' knowledge on these topics is quite important. This discussion raises the question of the government policies on the development and transfer of technologies that fit the demand of farmers. The IPM program in the delta as an extension tool must be designed in a different way than it is now to serve farmers' objectives. In the RRD, these are somewhat different than in other regions of the country.

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# Chapter 9
# RESEARCH AND EXTENSION PROGRAMS AND FARMERS' OPINIONS ABOUT THESE PROGRAMS

This chapter reviews strategies for research and extension in the region by presenting results from discussions with government officers at MARD, researchers, extension workers and farmers. In conjunction with findings of previous cases, this chapter analyzes government efforts and issues to be argued in the process of making decisions about technology development and extension in the RRD.

## I-Abstract

"Who and what receives financing" rather than "what is relevant to farmers" has determined research topics. This statement is not new with respect to the process of setting-up research and extension programs in the country. The government knows what are the main objectives to be achieved and tries to focus or allocate resources to this target. However, government objectives are applied for the whole country, but are sometimes unsuitable or inapplicable for a specific region. As we can see in the previous chapters, to reach the goal of the government, the strategy for agriculture is mostly to try to ensure food security in the country as a whole and within each region. In order to do so, the development of agriculture in the RRD has focused on programs of intensification of food crop production with an expansion of winter crop production. This can be done by introducing new crops, new production techniques, the use of hybrid rice and maize, and improved cropping patterns. Very few and unclear measures for the development of other ways of farming have been taken.

This chapter, as a special case, presents a review of research and extension programs in the country and especially in the RRD to understand what the government tries to do and how this differs from what farmers consider their needs for information and knowledge. The study focuses on the communication process for making policy on technology development and extension in the RRD. Special attention is paid to issues relating to policy theory; perceptions on agro-ecosystems with respect to trade-off between productivity, equability, stability and sustainability; farmers'

reactions to technology policy choices; etc. Most information is based on interviewing officers who worked in different departments of MARD, research institutes and extension agencies. Other sources of information are program/project documents from the Department of Agro-Forestry Extension (DAFE) and research institutes under Ministry of Agriculture and Rural Development.

## II-Materials and methods

From January 1999 to March 2000, 28 policy-makers, researchers and extension officers of different institutions (at central and provincial levels) were interviewed. They were working at different sections belonging to MARD such as DAFE, Department of Science and Technology Management, National Food Security Committee, also researchers from five research institutes were interviewed. Because the type of work of the extension stations in the six districts[73] visited is mostly administrative, only one staff member in each station was involved in the interview. I also had an opportunity to discuss with one person from central VACVINA. During the interviews with eighty farmers in different locations of the six districts in the RRD, the respondents were asked to present their opinions on the communication process of research and extension programs/projects in their area. In addition, the study also reviewed documents relating to research and extension programs/projects (in brief only) of ten research institutes and four provincial extension centers.

The content of the questionnaire and the type of questions asked was modified after being pre-tested on some individual interviews with officers and also farmers in both central, provincial, district and village levels. On average, each questionnaire for officer interview (as expert interview) took about one hour. The questionnaire was aimed at getting a clear picture of the communication process between related actors involved in designing, implementing, monitoring and evaluating technology development and extension programs/projects.

There were two groups of interviewees, experts/officers (policy makers, researchers, and extension officers) and farmers. The main questions asked in the officer interviews were how policies for agricultural research and extension were chosen. Why were they chosen? What were the policies on research and extension? How and why do farmers behave the program/project on technology development and extension? The later question was also used in farmer's interviews. The question of how can the policy fit the farmers' needs was asked in both officer and farmer interviews. Normally, information gathered from the previous discussion was checked in the next interviews. At the end of the interview, all information obtained was categorized according to above questions. The results are presented below.

[73] Number of extension officers working at the district station in six visited districts varies from 3 to 5 persons.

## III-Issues around research and extension programs

### III.1-Major directions for research and extension programs

As mentioned in previous chapters, the policy for research and extension with the operation of specific programs reflects government objectives on the development of agriculture in the country. In recent years, the programs were designed for the whole country, but not for each specific region. Most research and extension programs aimed at intensive farming, the development of high yielding crop varieties, technical measures, the export of agricultural products, promotion of agricultural diversification, etc. However, the realization of these policies depends on farm management decisions that farmers will make. Through education and information, subsidies, price policies, improvement of transport facilities, etc., the government can stimulate that they take decisions which are in agreement with these policies, but farmers are to large extent free to take decisions that they consider to be in their interest. Therefore, during the interview I discussed these issues with them. Also other related actors, I asked their opinion of and experiences with these policies.

*III.1.1-Intensive farming and increase of cropping intensity*

In order to exploit the land potential effectively in each region, some studies on intensive farming and increase of cropping intensity have been designed:

- Assessment and identification of regional land use by using Geographical Information System (GIS).
- Study of existing and future land capacity and suitability, land use type and water resources for small-scale agriculture.
- Studies on increasing land use index (LUI) dealing with suitable (rice) crop varieties, short maturing, procedures of intensive farming, farming systems, irrigation and drainage.
- Study on technology for exploitation, protection and improvement of soil fertility, prevention of erosion, flood control and saline contamination.

These studies were approved in conjunction with an intensification program to assist policy-makers to know more about the availability and potential of the natural resources in the country. According to the policy-makers interviewed, most decisions on the development of agriculture are based on this information.

With respect to the conditions of the RRD, interviewed researchers and extension officers showed their interest in this direction, but the feasibility of research findings in practice is still a question. They mentioned that, during the period of 1970-1980s, there were a series of land-use maps produced by scientists for the use in setting cropping patterns in provinces of the region, but

the result was disappointing (no evaluation data available). After that, nobody can find advantage in the use of these maps in the RRD. The situation at the farm level now changes totally with the decision to leave to individual farmers' decision about cropping patterns. Most of the interviewed farmers (62%) said that they want to know how suitable their farming system is with respect to natural conditions such as weather, climate, soils, and water, but that is not enough. They also like to know more about their socio-economic environment in terms of marketability of their products, and prices, and how to manage their farm effectively.

In general, all informants agreed that this direction for research and extension programs in the RRD could be seen as technically appropriate, but according to the farmers it needs to be complemented by measures on the socio-economic aspects.

*III.1.2-Studies on selection and creation of high yielding crop varieties*

The following measures have been introduced by MARD to create high yielding varieties as guides for the intensification of agricultural production and the diversification of agriculture:

- Study on the selection and creation of pure and hybrid rice varieties with higher yield (8-11 tons/ha/crop season), good quality and suitable to various ecological regions of the country. In the next few years, more attempts will be made to create hybrid paddy varieties with the yield of 10-14 tons/ha/crop season. Selection and creation of pure paddy varieties with average yield of 10-12 tons/ha for the use in the areas of the intensification program and other pure varieties with an average yield of 8-10 tons/ha for difficult and inaccessible areas.
- Selection and creation of new crop varieties including hybrid and free pollinated maize strains with a yield of 10-12 tons/ha/crop; varieties of potato with an average yield of 30-40 tons/ha; and varieties of cassava with an average yield of 40-50 tons. New vegetable varieties with an additional yield increment by 20-23 per cent will be developed.

In recent years, this direction of higher yielding crop varieties has absorbed most of the attention of policy-makers and researchers. In the case of VASI, about sixty percent of research projects have been annually devoted to serve this objective (information from VASI). However, it appears the farmers have different ideas and perceptions about this issue under conditions of the RRD.

As shown in the case of the changing land-use systems (Chapter 6) and TPS-based production (Chapter 7) in the RRD, rice yields of about 13 tons/ha/year have been reached by farmers in Trong Quan commune, or more than 10 tons/ha in Nam Thanh district. Average rice yield reached by eighty interviewed farmers was about 11 tons/ha in 1999. Most interviewed

farmers (70 %) in the areas of fertile land (such as Dong Hung, Chau Giang, Thuong Tin and Nam Thanh) and lower fertile land (e.g., Y Yen and Binh Luc) answered that they found it is difficult to increase their rice yield. The introduction of new high yielding potential varieties does not make sense for increasing the productivity, if existing production conditions (better availability of inputs) were not improved. Moreover, eighty percent of them showed less attention to the productivity of rice because this crop does not increase their money income much. They said that: "we will be happy if our rice gave higher yield, but we will be more happy if our cash crops provided higher productivity".

*III.1.3-Studies on technical measures of intensive farming to improve the yield and product quality*

- Studies on technical measures for intensive farming to improve the yield of cereal and subsidiary crops focusing on fertilizer use at various agro-ecological sub-regions.
- Study on Integrated Pest and Diseases Management and setting up disease free zones.

These studies are mainly the responsibility of scientists from National Institute for Soil and Fertilizer and National Institute for Plant Protection (see also Table 3 in Chapter 2). With regard to messages on fertilizer use in the region, most of interviewed farmers (60%) said that they received the message from extension network during resent years, but it was only gave general recommendations and they found hard to apply than in their specific and very diverse situations. Other farmers found this advice about how to use fertilizers effectively not useful.

Other measures concerning plant protection are not much appreciated by farmers, as described in the previous chapter, especially given the neglect of cash crops. There were five of eighty interviewed farmers who had attended the IPM FFS training, mainly on rice (see previous chapters). They were very interested in the approach and hoped to participate in training courses on cash crops and fruit trees. With respect to the IPM program on other crops, 90% of officers interviewed said that is a very difficult task because of diverse demands on different crops and the lack of resources in terms of personnel (trained-staff), finance, time and also knowledge available. The National Institute for Plant Protection is a partner as an implementer of the country IPM training program supported by FAO, but the work on crops other than rice is restricted to some areas.

About sixty percent of farmers interviewed argued that above measures do not satisfy their need to organize themselves to more effectively use technical measures. They need some help in establishing an organization. According to them, this issue is also very important in the case of pest and disease management.

*III.1.4-Studies on improved technology for exploitation and conservation of water resources and effective uses of existing irrigation and drainage facilities*

- Assessment of existing water resources, irrigation and drainage facilities.
- Improved technology for controlling and managing water and soil fertility.
- Requirement of water for different crops at various physiological stages, moisture status of soil and water regimes.
- Improvement and development of irrigation facilities suitable for different topographies.
- Technical measures for erosion control.

As mentioned in chapter 6, some problems are appearing in areas of changing land-use systems as a result of broken down irrigation networks. Every one knows it, but yet there are no solutions for this problem. According to officers, the situation in the area of new farming systems needs to be paid special attention in re-designing both the on-farm and community irrigation network. That requires assistance from the government and participation of the farmers and their organizations.

*III.1.5-Studies on the promotion of agricultural diversification*

Research and transfer of technology activities for the promotion of agricultural diversification have been focused on:

- Selection and development of plants varieties and animal breeds with higher performance and suitable for different areas.
- Identification and extension of cropping patterns with high economic efficiency in different areas.
- Setting-up special crop zones.
- Production of rice for local consumption and supply to the mountainous regions of the North. Development of maize, subsidiary crops, vegetables and fruits for export in the RRD.
- Studies on marketing and price policies for agricultural diversification.
- Strengthening extension services at all levels.

According to information from the officers' interview, different research institutes mentioned in Table 3 (Chapter 2) have worked in this direction. However, they said that most of the research topics were based on technical measures, few topics on marketing were conducted by the Agricultural Economic Institute (AEI). The studies on the development of export products are very difficult for the RRD because of small-scale producers and lack of necessary measures or standards, which leads to a low quality of the product. Post-harvest technologies in the region are not yet developed.

From the farmers' point of view, as mentioned in previous chapters, rice is not seen as cash crop. They are selling some part of their rice harvest because of family demands for cash. During the last few years, the farmers used to sell their products (rice and other farm products) to middlemen at unstable and unpredictable prices. Some of them are afraid that the price of some marketable products, such as fruits, potatoes and vegetables, may decline due to increasing production in the region. Competition in free market is appearing with litchi fruits. They do not know how useful studies on marketing and price measures can be to provide them with information about the experiences with marketing organizations elsewhere and how they can organize themselves to deal with market problems.

*III.1.6-Extension program for the introduction of new varieties*

In general, the program designed for recent years aimed at:

- At least 50% of maize areas will be under the hybrid maize production, by providing incentive to the farmers to produce hybrid maize seeds.
- Use of special fruit trees suited to different agro-ecological zones. Expansion of the area under improved varieties. Technical transfer of producing breeding materials, variety collection, improvement of home gardens.

Policy-makers answered that this direction is applied in the whole country, but not in specific regions. In the last period, the hybrid maize program has made a great contribution to the growth of agriculture in the country, but it is facing some problems in the RRD because the land area allocated to this purpose is limited. Only some areas in the region are devoted to growing maize in the winter season. With respect to fruit trees, the program focuses on hill areas of the Northern Mountainous and Southeast regions of the country, but some attention is given to the RRD where special fruits such as longan and litchi are planted traditionally (no data mentioned).

The farmers who took part in my interview see maize as food, but not a cash crop in which they are interested. Only some of them (12 interviewed farmers) are planting maize in an area outside the dyke of the Red River. The farmers in the region do not like to grow maize in the winter season because this cropping pattern requires land to be available in early September. That would influence their summer rice crop yield (see Chapter 7), and maize is not one of ingredients of their diet. The promotion of home gardens including animal raising and fruit tree planting absorbs the farmers' attention. However, in the last decade, government efforts in technical and also marketing measures for this issue has remained limited in the region (Chapter 6).

From these directions, some specific extension programs have been designed for implementation in recent years:

1-Agricultural extension programs for Food Crops: Hybrid rice and maize crops are seen as an important strategy of research and extension works in the country to deal with problems of food shortage and the demand for foreign exchange (export rice). With the assistance of FAO Hanoi, the expansion of these hybrid crops is put into the following specific research and extension projects:

* The project of rice production by using hybrid lines;
* Production of hybrid rice species (F1);
* Maize production by using hybrid lines; and
* Production of hybrid maize.

2-Agricultural extension programs for Industrial Crops and Fruit Trees: For the whole country, some major industrial crops and fruit trees are chosen for introducing to farmers as extension programs in different regions.

* Sugar cane;
* Coffee;
* Cotton;
* Other industrial crops; and
* Fruit trees (not specifically mentioned).

3-Agricultural extension programs for Animal Husbandry focus on:

* Increase of pig herd and pork output;
* Raising lean meat pigs;
* Agricultural extension model for poultry;
* Extension Program for improving local cattle;
* Increasing the proportion of crossbred cattle in the total cattle herd;
* Agricultural extension program for dairy cows;
* Agricultural Extension for improving the goat herd; and
* Agricultural extension for bee keeping.

4-Training, Organization and Information Supply for Peasants.

5-Forestry Extension Programs according to the crop structure and to the program.

### III.2-Implications

As mentioned above, agricultural research and extension programs have reflected the government strategy with a strong emphasis on the crop productivity and for export. One example is the case of the provincial extension center in Hai Duong province (see Box 6). This strategy was based on the perception of food security and the need for foreign exchange. In fact, as mentioned in Chapter 1, the problem of food shortage still persists somewhere in mountainous regions of the

country. However, as interviewed farmers said that increasing crop productivity is necessary, but not enough for improving farmers' incomes.

There are seven different socio-economic and agro-ecological regions in the country. To some extent, the operation of research and extension programs during the last period seems not to fit the demand of farmers in a specific region like the RRD. As we see in the previous chapters, farmers in this region are trying to improve their income by changing their farming system. This process requires research and extension programs which pay attention to the objectives of the farmers in the region.

**Box 6: Extension activities done by Extension Center of Hai Duong province**

**Achievements in 1999**

The Agricultural Extension Center in Hai Duong province with its personnel at the provincial level are of 49 members who graduated from six different disciplines: 22 of them graduated in crop science, 13 in animal science, 1 in soil science, 1 in forestry, 3 in aquaculture and 7 in economic. There are 12 extension stations at district level with an average of 3 staff members working in each station. The operation of the center concentrates on two main fields: training and demonstration.

***Training***: in 1999, the center organized 773 short training courses on different topics of rice crop production (603 courses), animal raising (125 courses) and aquaculture (45 courses) with the participation of 54,500 farmers. (No training courses were offered on cash crop production).

***Demonstration***: there were more than 80 demonstrations on crop production, animal and fish raising, and the VAC model established in the year:

- Crop production: The demonstration was on a new transplanting method for rice in the field of 1,570 farmers; intensification of hybrid rice in the area of 2 ha; fertilizer application in 7 ha of rice, maize and potato with the participation of 143 farmers; testing potential rice varieties in 4.8 ha with the participation of 77 farmers; and TPS demonstration in winter season in 10 ha with 145 farmers;
- Animal husbandry: The demonstration concentrated on cattle, pig, poultry, and animal feed;
- Aquaculture: The demonstration on raising fish was established with the participation of 10 farmers.

(Record No. 09BC/KN from Hai Duong Extension Center, 25 January 2000)

## IV-Decisions-making process

According to information from the interviews (from interviewing officers and farmers, and reviewing documents), the decision-making process for research and extension programs can generally be responded as "top-down". The research and extension programs are often defined and designed by high level authorities. With regard to the objective of each program, research and extension organizations annually receive funds for their implementation. However, linkage between policy-makers, research and extension on different levels and farmers in the process is weak (Figure 7).

Normally, the cycle of program/project preparation and implementation in the region can be seen as:

State Objectives => Draft of Programs Designed by Gov. Officials => Program's Activities Proposed by Research or Extension Organizations => Resources Balanced by Gov. Officials => Programs Finalized => Programs Approved by the Ministry Authority => Program Implementation, Monitoring and Evaluation.

Because of extreme concern for food security and the government effort to promote crop productivity, other aspects of whether the farmer can benefit from applying official innovation, are often unknown. According to the officers interviewed, there was very little or even no feedback from the farmers on appropriate technologies, markets of inputs and outputs, etc., to research and extension programs. This also implies that farmers are sometimes not interested in technologies introduced by research and extension.

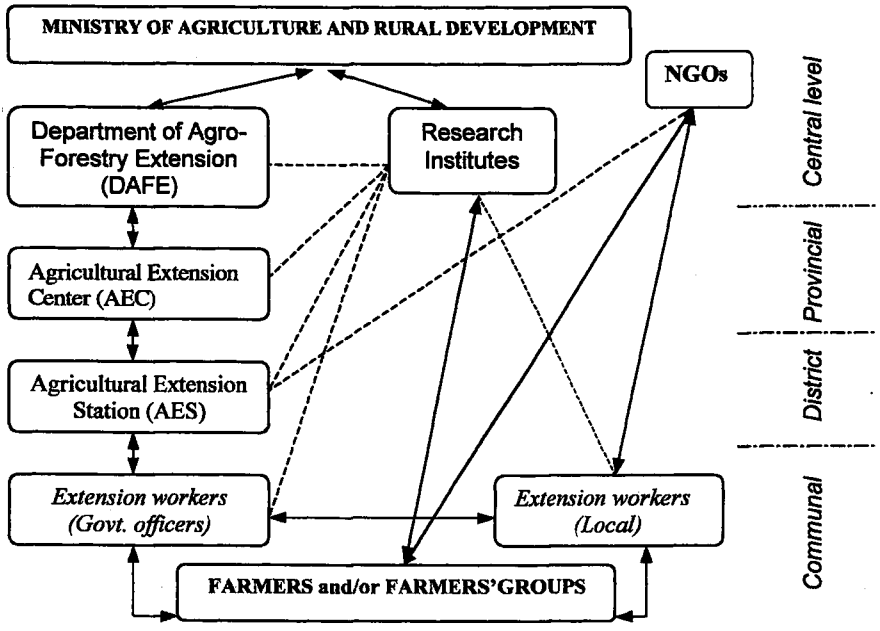


**Figure 7 - Linkage model between policy-makers, research, extension and farmers in the RRD**

Strong linkage ---------- weak linkage

In the field of research and extension work, most of program concerns are on technical aspects. According to some researchers from VASI, that is one of reasons why many new technologies developed by scientists disappeared quickly after only few years of application.

## V-Conclusion

There are different ideas and perceptions between officers and farmers in two groups of interviewed people about direction and policy-making processes for realistically operating research and extension program/project in the RRD. This resulted from a lack of a good linkage between related actors.

Under conditions of new open market economics, the RRD has a quite different potential for agricultural development than the other regions in the country. The research and extension programs to be implemented in the region have strongly reflected official technological innovations with little attention paid to other aspects. The argument is that farmers in the RRD have different needs that were not heeded by research and extension in the last period. More emphasis on food security and foreign exchange is not appropriate and hard to make applicable under the conditions of the region.

# Chapter 10
# CONCLUSIONS AND IMPLICATIONS

## I-Introduction

As presented in previous chapters, most agricultural research in Vietnam has understandably been technical in nature. There is very little research on the innovation and policy formulation processes. Hence, there have been few reflections on how research and extension organizations interact with farmers to facilitate the development of agriculture that is sustainable. Few research and extension organizations have formulated clear principles, targets and goals, clear methods of monitoring their impacts, or have established procedures for improving their responsiveness to farmers' needs.

Chapter 2 presents problems of lack of a clear distinction between strategic choices available to research institutes and to extension agencies in the RRD. The room for research and extension policy choices in practice has been pre-empted by explicit or implicit agricultural policy choices and the specific, local functioning of other forces in rural development, such as markets and the price of products. Policy makers remain unaware of the situation in the field and of the barriers to making realistic policies. This results in the lack of policies that are enabling, and create conditions for sustainable development based on locally available resources and on local skills and knowledge. In this context, the question of a significant gap between the ways individual farmers and institutions make policy and the available knowledge on how policy can be made, must be addressed.

Official policies are based, whether explicitly or not, on ideas about "what works" in term of stimulating agricultural innovation. These theories can be quite explicit and in contrast with an analysis of the innovation processes that actually take place in farming communities. From this comparison it is hopefully possible to formulate more effective theories about innovation to underpin agricultural policy and intervention, and to identify procedures by which the government capacity to assist farmers can be renewed and respond better to farmers' needs.

This study uses case studies of innovation processes in the densely populated Red River Delta, and of official models of agricultural innovation, to develop theories to underpin technology (agricultural research and extension) policies of Vietnamese government organizations. The overall hypothesis is that the innovation theory currently underpins agricultural technology policy in

Vietnam does not adequately reflect the dynamic processes that take place in the field in the context of the (new) open market economic system.

This study aims to look both at

(i) farmers' innovation processes; and

(ii) official innovation theories and efforts;

to diagnose the problem identified and suggest more effective policy theories and procedures for supporting farmers' innovation.

In order to reach the objectives of this study, there are some key questions that need to be answered during the course of this study:

1) Is there a gap between the way farmers innovate and the way institutions make policy? If yes, what gap?
2) What kinds of knowledge and information from which actor are relevant to making decisions?
3) How and why do farmers and their communities react to government policies for technology development and extension to deal with problems of agricultural development in the RRD?

These questions have been translated into specific questions as followings:

a) How are policies for agricultural research and extension chosen? Why are these policies chosen in this way?
b) What policies do research and extension agencies use?
c) How and why do farmers behave regarding innovations promoted by the government program on technology development and extension?
d) How do farmers actively develop their (new) farming systems?
e) What do they think about innovation? How does 'the system' work?
f) Why are farmers trying to innovate in ways that are not in agreement with the concerns of the government?
g) What are differences in interests or needs between the government and farmers? Why?
h) How can the policy fit farmers' needs?

Through the interview and study of four cases: new farming systems, new technologies and the choice of farmers, the IPM program, and research and extension programs in the RRD, this study touched on aspects of policy theories for designing technology development and extension programs in the region. Situations in the field asserted that, during recent years, there were appearing different perceptions between state agencies and farmers in terms of strategy choices in farming and dealing with problems of livelihood in rural areas of the RRD.

With respect to the process of technology development and extension, linear models of technology transfer with weak linkages between related actors did not show advantages even under conditions of irrigation in the RRD. Throughout the case studies, we can see government policies based on arguments of food insecurity that strongly emphasize higher productivity per hectare for the agricultural development in the region. Contrarily, farmers are very dynamically developing their innovations to cope with problems of scarce natural resources. A high income with special interest in the development of cash crops is one of farmers' strategies. This trend leads to new challenges for both farmers and government agencies in reaching sustainability of agricultural development in the RRD.

## II-Conclusions about research questions/hypotheses

### II.1-The choice of policies for agricultural research and extension

Based on the argument of food insecurity and the need of foreign exchange, the government has introduced policies for technology development and extension. The two main solutions for the development of agriculture in the RRD are taken to be intensification and diversification programs. The *Intensification* program is based on the assumption that the development of agriculture under conditions of the region will require a high level of productivity and that this process is driven by technology. In a conventional way, ideas of technology come from research stations to be applied by farmers with the help of extension agents. A series of directions for official innovations has been introduced (Chapter 9) with much attention given to high productivity of crops and animals per unit of production (ha). On the other hand, agricultural *diversification* program managers, in the policy-makers' point of view, saw the expansion of winter crop production as a starting point that can resolve problems of food insecurity, lack of arable land and rural unemployment. Many efforts have been made to promote the development of winter crops such as potato (Chapter 7), maize, and vegetables.

With respect to the improvement of farmers' competence or knowledge about crop production, the IPM extension program has been introduced in the region. This (IPM) activity is to serve the performance of intensification and diversification programs, but in fact, mostly promotes rice production and still faces difficulties itself (Chapter 8).

The lack of research and extension works in the field of farm management, and processing and marketing of agricultural products reflects weakness in understanding the knowledge system perspective. As discussed in Chapter 5, 6 and 7, increasing production of rice, potato, fruits, and fish, etc., may lead to a surplus of these products and so to low prices as is explained by the agricultural treadmill theory. However, no systematic attempt has been made to realize a balance in the supply and demand of these products.

## II.2-Strategies of research and extension agencies

In conjunction with government directions, research and extension agencies have proposed projects to be implemented in the region. As mentioned in the case studies, individual farmers are unable to ask for research and extension services. Although agricultural cooperatives are still operating in some areas and mass organizations have been formed in every commune in the RRD, these types of organizations seemingly do not show an advantage in supporting official and farmers' innovations. From discussions with farmers, researchers and extension workers, the conclusion is that the government officers are accessing individual farmers mainly to carry out their on-farm trials and experiments. Extension can only have some relations with "contact farmers" who are often better-off persons in some communes (Chapter 5, 6, 7, 8 and 9). The reason is that the research and extension simply do not have enough resources in terms of competent staff members, finance and time available to visit farms. In the recent years, very little on-farm research has been done. This approach leads to the lack of farmers' participation in technology development and extension and of feedback from farmers.

With respect to research and extension topics, as indicated in Chapter 2, most research and extension work is technical in nature and based on "what works". Following the direction from ministries such as MARD and MSTE, the research and extension agencies propose projects or programs for the development of innovations basically focussing on technical measures (Chapter 9). In case of the RRD, research and extension have mostly served productivity per unit of crops or animals at the expense of other desirable properties of the agro-ecosystem such as equitability, stability and sustainability. These objectives were based on the assumption that the development of agriculture in a densely populated region such as the RRD must depend on high productivity because the possibilities to expand arable land are limited. As mentioned, government officers think that this development of technology can resolve the problems of agriculture in this region. At the regional level, crop intensification and diversification have been understood as strategic orientations for technology development and extension. As mentioned in Chapter 9 and other previous chapters, this strategic orientation has been translated into projects or programs such as efforts in improving seed supply systems in case of TPS (Chapter 7) and food crop (e.g., rice, maize) productivity.

The formal extension network did not play a role in the IPM Country Training Program, but leaves room for other institutions such as NIPP and PPD and its branches at the provincial level to carry out this task. Box 6 (Chapter 9) presented a typical example of extension activities implemented at provincial level in the RRD. In addition, in recent years, the IPM program has mostly focused on rice production, but few efforts were made for other crops.

Low levels of farmers' participation and feedback in research and extension programs during the last years have resulted in a lack of appropriate technologies and market recommendations for new farming systems or winter crop production in the region (Chapter 5, 6 and 7). This problem led to differences in objectives and actions between the state agencies and farmers.

## II.3-Farmer behavior and the program on technology development and extension

In this study, with respect to the development of agriculture in the RRD, two types of official efforts to support farmer innovation and production have been made through the introduction of high potential technology. The first effort provides farmers with new crop varieties such as hybrid rice, maize and true potato seed, etc., while the latter aims at improving farmers' knowledge about the production process, e.g., the IPM program.

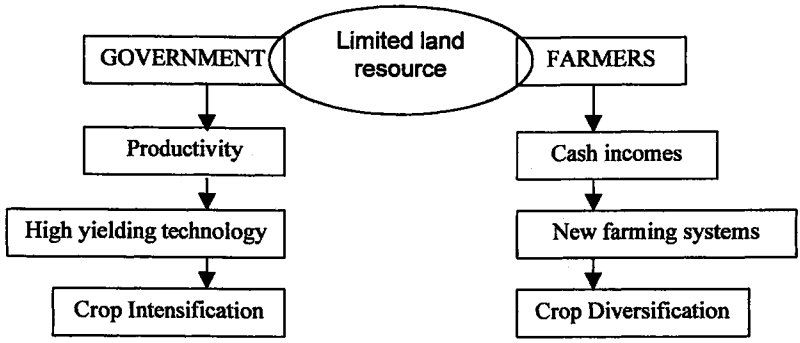


**Figure 8 - Government and farmers' solutions for problems of limited land resource in the RRD**

In the RRD where food shortage no longer exists, farmers have responded to problems of limited natural resources differently from the government (see Figure 8 and also Section II.7 of this chapter). As mentioned in Chapters 5, 6, 7, 8 and 9, the increase in cash income was the main objective of farmers. Although rice is one of the most important crops and many farmers sell rice, growing this crop is not seen as way to increase cash incomes for farmers in the RRD (it is different from rice in Mekong River delta). Government efforts in developing new technical measures to promote rice production in the region are not very desirable from the farmers' point of view. Even in the case of TPS-based production (Chapter 8), many efforts have been made to introduce this new technology, but results were still limited. Farmers saw TPS technology as a complex technical innovation that needs more training and demonstration, and the market for potato products was, in most communes, not as good as in Trong Quan where this technology has been introduced successfully.

Figure 8 presents a summary of farmers' strategies to cope with the problem of a small acreage of arable land, which is quite different from government policy on technology development and extension (see also Chapter 5 and 6). In this case, farmers try to keep the necessary area for planting enough rice for family use and are very active in developing new farming systems with more cash crops in the winter, fruit trees or fish raising. The figure shows that farmers try to diversify crop production, but efforts from government agencies aim at crop intensification. In the case of changing land-use systems in Nam Thanh district (Chapter 6), we can see that farmers are very busy with their new farming systems whereas extension tries to bring rice yields at the highest possible level (see also Box 6 in Chapter 9). In the case of potato production, investments by farmers in building cold store to resolve problems of low quality of seed-tubers in Ha Hoi commune and the reluctant adoption of TPS reflect reactions of farmers to the introduction of a new technology. Clearly, farmers see the market is one of the most important forces for choosing a farming system.

### II.4-Farmers are very active in farming

In Chapter 5 and Chapter 6, we found that, in the areas where rice productivity is expected to be low, farmers try to establish new farming systems mainly by planting fruit trees and raising fish. The choice of farmers is based on their knowledge about market demands for these kinds of products. During the first three years of tree planting, farmers also make full use of the land available by planting other kinds of crops (e.g., rice or vegetables) where possible. This strategy, at the one hand, provides the farmer with some returns to compensate family incomes before fruit trees give a harvest. On the other hand, this can reduce agricultural leisure that may take quite a long time until new requirements of family labor develops and the farmer may get incomes from fruit and other crops throughout the year that are more stable than those gained with rice production.

With respect to winter crop production in rice-based fields, in most cases, farmers as much as possible try to plant cash crops at the expense of food crops, such as maize and sweet potato (Chapter 5, 6 and 7). Although potato is seen as a cash crop, farmers found of difficulty to adopt new technologies such as TPS because of the requirements of complex techniques and problems in marketing the products. In the case of high cost or unavailability of seeds, farmers often switch to other crops instead of potato. This shows that farmers are very active and flexible in choosing their own strategy to respond to changing market demands.

### II.5-Farmers' knowledge and practices

As mentioned, farmers' objectives aim at higher cash incomes. This implies that knowledge about market demands is very important for farmers' choices of cropping patterns or changes of their land-use systems. Although rice is an important crop, the desire to increase their income in a similar

way as other population groups forces farmers to pay more attention to the expansion of winter (cash) crop production and to look for new farming systems. In Chapter 5, as well as in the case of the new farming systems in Nam Thanh (Chapter 6) and TPS-based production (Chapter 7), most of farmers' knowledge on market demands comes from their neighbors and other sources such as mass communication, traders, NGOs, etc., but very little from research and extension (Figure 9). However, in the case of litchi producers, they are still unaware of future benefits from the fruit tree because there are new challenges of competition of the litchi fruit in market (Chapter 5).

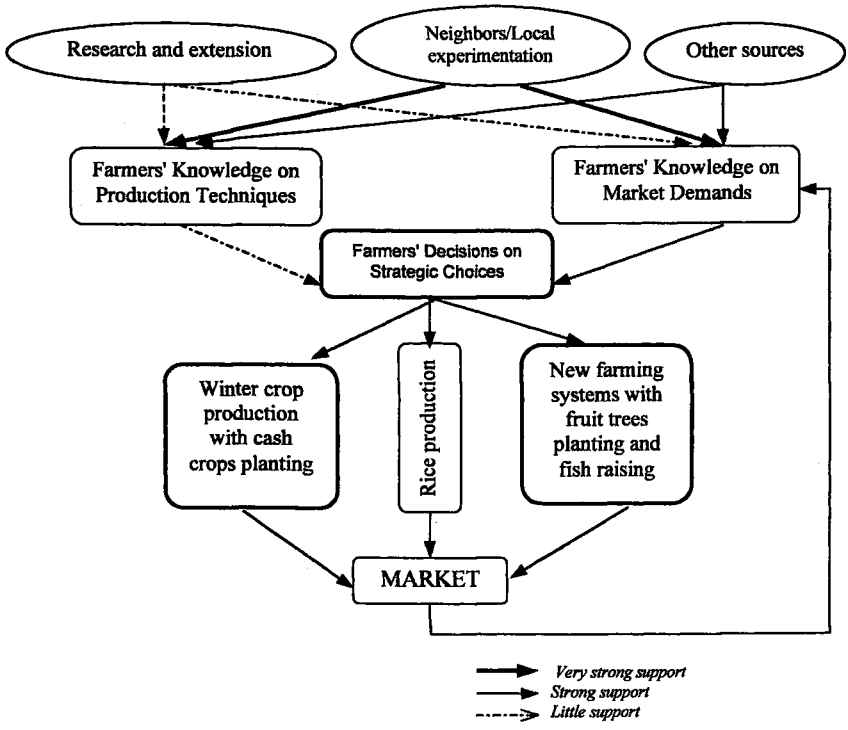


**Figure 9 - Major sources of knowledge on production and market to support farmers' strategic choices in the RRD**

Although many farmers in the region are more or less experienced in VAC horticulture, decision to change land-use systems in rice fields is one of the strategic choices supporting agriculture diversification. In fact, farmers have tried to establish their own experiments with new models of crop and/or tree planting and fish raising (Chapter 5 and 6).

In Chapter 7, we can see many efforts that government agencies have made to promote winter production of potato as one of potential cash crops. However, farmers were aware of unstable markets for potato products during recent years, and they make decisions on TPS-based production carefully as we can see in the case of Ha Hoi commune.

As mentioned, the IPM program is a good way to improve farmers' knowledge on crop production and, to some extent, to support farmers' innovation. In the case of RRD, farmers need to improve knowledge not only on rice, but especially on cash crop production (Chapter 8).

One of the emerging issues for cash crop producers is that most of their products will be sold in marketplace through middlemen who occupy advantages in this process. In these cases, farmers need to be well organized to protect their interests.

## II.6-Why farmers try to innovate in a way that is not the concern of the government?

In the RRD, farmers are now engaged in winter crop production and in many kinds of activities to develop new farming systems. In the case of changing land-use systems, most of farming practices have been developed by farmers without assistance from government agencies. There are two main reasons that explain why farmers try to innovate in other directions than the government tries to develop agriculture. Firstly, there are differences between the government and farmers in terms of objectives, perception of farmers' problems, and decisions on strategic choices (see Section II.7 below). And secondly, there is an absence of government efforts to support innovations in new farming systems. These issues can be found in Chapter 5, 6, 7, 8 and 9 where we discussed how the government paid most attention to increasing the productivity per hectare of food and export crops. Many government efforts have been made to introduce technical measures for agricultural production during the last decade, but these did not fit farmers' needs.

## II.7-Different objectives between the government and farmers

There are some processes creating differences between government and small farmers in terms of their objectives, actions and responses to the problems encountered during the course of agricultural development in the Red River Delta.

Firstly, the government has strong emphasis on ***food security*** as applied for the whole country. As presented in Chapter 1 and Chapter 2, the RRD is quite different from other regions in terms of natural and socio-economic conditions. In the country, the RRD and MRD are the most important regions for rice production. However, one of major factors making a difference in farming between two deltas is the availability of land. The average farm size in the RRD is very small. Compared to other regions, the RRD has a better irrigation network and farmers have a long experience in farming there.

In the last decade, with a small acreage of land, food production in the region was stable and the farmer produced enough food for household use and some surplus for selling to other regions and/or for export. Has the farmer in the RRD reached government objective of food

security? The National Food Security Committee (NFSC)[74] defines food security in terms of three components: food availability, food accessibility and food stability. It also distinguishes three levels: enough food (the family has enough food including rice, maize, sweet potato, cassava, etc., to eat); food security (a broader term, including to diverse products as egg, meat, fish, vegetables, etc.); and household food and nutrition security (family having enough food containing diverse components needed for healthy nutrition). In the RRD, are farmers in the process of reaching the second level of food security?

The first component of food availability implies the productivity of food crops so that the farmer can satisfy family needs. In this sense, we can see most research and extension activities in the RRD during last period aim at increasing this type of productivity (Chapter 9). The idea of food accessibility sometimes leads to a misunderstanding. The increase of farmers' income can be seen as one solution with respect to their access to food. The farmers can improve their income by planting more cash crops (especially in the winter season) and they can also make changes in the VAC systems. Information from my interview at different locations shows that farmers in the delta can produce or have access to a diverse food basket for family use. Many farmers there now do not worry about food, but they still worry about cash incomes for satisfying other family. needs (see Chapter 5, 6, 7 & 8). However, the third component of food stability, as defined by the NFSC, is still a question because many unforeseen difficulties may occur during the production process. In addition, the marketplace is also one of very important factors contributing to the stability of food. We see that many farmers in the RRD are now very active in capturing a market for their products whereas measures on this issue from the government organizations are not available.

Thus, the emphasis on food production in the process of agricultural development in the RRD may be unnecessary, given the farmers have different needs in growing more cash crops or changing to other ways of farming.

Secondly, the government has given more attention to ***productivity*** per hectare of crop in the intensification program and the operation of research and extension projects is designed mostly for technical measures (for example, the adoption of hybrid crop varieties). In the meantime the price of rice has steadily declined (IFPRI, 1995; GSO, 1999), because the efficiency of rice production elsewhere in the world increases. The low price of rice leads farmers in the region to look for other solutions for cash income problem. All interviewed farmers in Nam Thanh and Gia Loc (Hai Duong province), Khoai Chau, Van Giang (Hung Yen province) [75], etc., while trying to

[74] *The National Food Security Committee (NFSC)* has been established since 1998 with the participation of officials from different Ministries and has an office located inside MARD building. The definitions of Food Security have been discussed in a seminar held in Hanoi by FAO, MARD and National Institute of Nutrition (NIN) in Sept. 1999.

[75] Especially, farmers living in the suburbs of cities or towns are very innovative in responding to the market demands.

keep a certain area for producing enough food for the family's use, changed to growing other crops or establishing the VAC model on the rest of land. Farmers are active in trying to make full use of the available resources in an effective way. In the winter season, the land that is suitable for planting winter crops has been used mostly. About thirty percent of cultivated land (more than 200,000ha - Tinh *et al.*, 1996; Chau, 1998)[76] in the delta is registered as "flooding-land" where rice yields are low and unstable.

There is some difference between farmers' and government perception with respect to the concept of productivity. The small farmer with limited area sees productivity as the capacity of a unit of land in providing family income, whereas the government prefers to focus on crop yield[77]. So, each farm comprises diverse-farming activities not only single crop production, but also animal and/or fish raising, etc. On the other hand, the government tries to develop and introduce technical measures that are based on only some specific crops or animals. In fact, many farmers are not interested in some of these measures. For example, in the case of TPS technology (Chapter 6), although it is seen as a potential solution for increasing farmer's incomes, farmers can choose alternatives from other cash crops for their winter crop production. The reaction of farmers to the IPM program on rice production in the RRD also reflects a different perception of farmers about what is needed (Chapter 8). In the region, the development of technologies from efforts of state agencies does not always fit farmers' needs. In most cases, the availability of markets for inputs and outputs is an important factor influencing the farmers' decision on which crops should be chosen for planting to fit their need for cash income.

Thirdly, the ***market*** is still a hidden force for both farmers and the government. In fact, individual producers with a small amount of product presented their worries that they may be warning into serious problems with a loss or failure in the market. Most of farmers in the RRD, as individual producers, have difficulties to sell their products to middlemen at a reasonable price[78]. The promotion of earning foreign exchange as government strategy to export more agricultural products is necessary, but many people realize that the domestic market is also important. Although many farmers sell rice in the market to satisfy the family's needs, such as health care, school fees, payment of production costs (new seeds, tax, irrigation fees, material inputs, etc.) and so on, rice production has never been seen as commercial activity in the region. Apart from rice, other products that are seen as commodities are small amount of meats, fish, winter crop products, fruits, vegetables, etc., which are facing difficulties in the qualification for being exported. Furthermore,

[76] See also Chapter 6 - Changing land-use systems ...
[77] The government counts in value of the production in suburban areas where farmers planting many different kinds of crops.
[78] A study on the chain of rice showed that the middlemen often get 40% of total profits from rice production in the RRD. Ha, P.H (1996): *Study on the Chain of Rice*. In: Annual reports on Farming System Research, VASI, 1997.

most of those products are still having good opportunity in the local market because aggregate supply is under the demand. The tendency to export agricultural products during last decade may have opened the local market with more than fifteen million consumers to penetration or even domination by imported products such as fruits from China.

**Table 27 - Different needs and strategies of the government and farmers in the RRD**

| | Government | Small farmers in the RRD |
|---|---|---|
| GOAL | • Assist the wealth of farmers | • Achieve wealth |
| OBJECTIVES | 1. High rate of GDP;<br>2. **Food security**;<br>3. High income of the farmers. | • Add value to limited resources;<br>• **Cash income.** |
| STRATEGY | 1. Promote higher **productivity** per hectare (intensification program);<br>2. Diversify farmers' incomes (diversification program);<br>3. Create more jobs in rural area. | • Keep stable food production (for family use) while planting **more cash crops**;<br>• Expand winter crop production;<br>• Change land-use systems;<br>• Look for non/off-farm activities. |
| PROBLEMS/ CONSTRAINTS | 1. Lack of appropriate technologies;<br>2. Unclear strategy for the development of agriculture in the RRD;<br>3. Unpredictable market;<br>4. Limited resources. | • Land-use regulations;<br>• Unstable market/low price;<br>• Lack of appropriate technologies for new farming systems;<br>• Pests and diseases attacks;<br>• Lack of capital, etc. |
| RESPONSES | 1. Promote the use of **high yielding** varieties and breeds;<br>2. Emphasis on foreign exchange (**export**);<br>3. More programs on technology development. | • Exchange land area to reduce number of plots;<br>• Change cropping patterns;<br>• **Try to make their-own innovations** in farming. |

Finally, ***linkage*** and ***communication*** between actors involved in the process of agricultural development in the region is seen as weak. This problem results in a lack of knowledge about farmers' situation and thus, in misunderstanding of what are farmers' needs among policy-makers and managers of research and extension programs. This results in less effectiveness in implementing programs such as in the case of TPS-based production or attempts to expand the IPM program for rice crop production in the region. This is not to say that the previous programs were wrong. These programs could be more effective if a better linkage between policy-makers, research and extension workers, traders and farmers had been created. The lack of farmers' organizations operating in the rural area also makes it more difficult to improve the communication and policy-

making process. In addition, a 'top-down' approach still persists in every stage of the project cycle, this does not create a good condition for getting feedback from farmers.

With respect to the technology development and extension process in the region, different perceptions on objectives, strategies, problems and solutions between farmers and the government are presented in the Table 27.

We already discussed that the core issue relating to the development of agricultural innovation in the RRD is that the government has paid more attention to productivity than to the diversification of agriculture. The government tries to develop policies to promote technical solutions while farmers are very active in looking for wider ones concerning a diversification of their incomes. The IPM program, as one of tools for supporting the development and extension of new technologies, seems to have little advantage in serving the strategy of farmers.

### II.8-How can technology policies fit farmers' needs?

Information from the study shows that with respect to technology development and extension, the policy can be improved to fit farmers' needs better. The conventional way for making technology policies, such as linear models of TOT and Diffusion of Innovations, is not the most effective way to reach farmers' needs. The "top-down" approach used by research and extension programs is no longer appropriate for supporting farmers in the region. ***Farmers' participation*** in all phases of the project/program cycle and ***feedback*** from beneficiaries are conditions for implementing policies efficiently. Because there is a large number of farmers in the RRD (about three million), a program on technology development could not involve all of them. Policies on the promotion of farmers' organizations are needed. Representatives of farmers' organizations can participate in the process of project/program preparation, implementation monitoring and evaluation. The methods of Participatory Technology Development (PTD) are desirable, especially in the case of changing land-use systems.

Looking at the process of cash-crop production and new farming systems, policy-makers with their concern about ideas of agricultural treadmill can help research and extension organizations concentrate their work on resolving problems of farmers in farming and marketing their products. The ***Market*** is one of important factors in supporting farmers' innovation.

In practice, the promotion of productivity is very important element in the implementation of programs on intensification and also diversification. However, the productivity concept should be understood not only as higher yielding crops or animals, but also as total (value) of incomes obtained from a counting unit. This implies that technology policies are appropriate in supporting farmers' innovation if they serve their objective of making a higher ***money income***. Hence, a policy for the promotion of food crop production is not desirable at this time.

***Training*** and supporting ***farmers' organization***, as mentioned, are activities that should be given attention in the policy-making process to enable farmers to improve their knowledge on new technologies, empowering them in marketplace, and calling for help from research and extension. (See also Section V and VI below).

## III-Conclusions about the research problem

As mentioned, most recent research and extension programs in the RRD aimed to promote technical measures. The starting point of these ideas is the perception that the scarcity of arable land requires better technology. Thus, the increase of yields per hectare is seen as one of the most important factors to be targeted. In recent years, policy-makers saw new technology as the main source of growth for Vietnamese agriculture. Such new technology can only be obtained from investment in research. With respect to innovation, government efforts have tried to improve the operation of research and extension programs in order to find ways for improving crop or animal productivity/yields.

Farmers (in Chapter 5) have recognized the presence of official efforts, e.g., the introduction of new crop varieties and the IPM program. Chapter 6 provided information about intensification program with the introduction of hybrid crop varieties of rice, maize and potatoes. In Chapter 7, government efforts to reduce problems of seed potato production were presented, as the expansion of true potato seed in the winter season. Chapter 8 showed many efforts from government agencies to introduce an IPM program. This was a good way to improve farmers' knowledge on crop production. Official efforts to develop and introduce technical measures to farmers through research and extension programs were discussed in Chapter 9.

However, the interventions mentioned above were in contrast with an analysis of innovation processes actually taking place in the farming communities. Farming communities in the RRD focus on diversification with more cash income as the strategic orientation. We can see from Chapter 5 how farmers have presented dynamic solutions for their low-income problems by planting more cash crops, expanding winter crop production, switching to new farming systems, etc. Chapter 6 presented farmers' innovation in the areas of "flooding-land" where low rice yields were experienced in the past. Chapter 7 indicated that although TPS technology is seen as a potential solution for solving problems of potato production in winter season, farmers saw that is a complex solution, which needs more training, and has first to be verified in practice. In the case of Ha Hoi commune, farmers are still using traditional methods of potato production. In Chapter 8, again we can see how farmers presented their reaction to the IPM program in rice. In those cases, farmers presented their needs for more cash crops, appropriate technologies for new farming systems and marketing of products.

This comparison hopefully provides ideas which make it possible to formulate more effective theories about innovation to underpin agricultural policy and intervention, and to identify procedures by which state capacity to assist farmers can renew and respond to farmers' needs.

## IV-Implications for theory

Although policy-guided interventions played an important role in inducing change, the principal force determining their value was the perception of the advantages of these interventions by the farmers themselves. They remained the ultimate decision-takers and those who have managed to diversify have increased their incomes and contributed to overall agricultural growth. The local suitability of emerging technologies is profoundly influenced by variations in the physical and socio-economic environment, such as soil characteristics, climate, hydrology, market, price, and so on, matters in which there is no one better informed than the farmers themselves. Ultimately farmers will have to make the final decisions, because they bear the risks involved in these decisions. This implies that, *farmers' participation* in the process of making policies on technology development and extension will play a very important role.

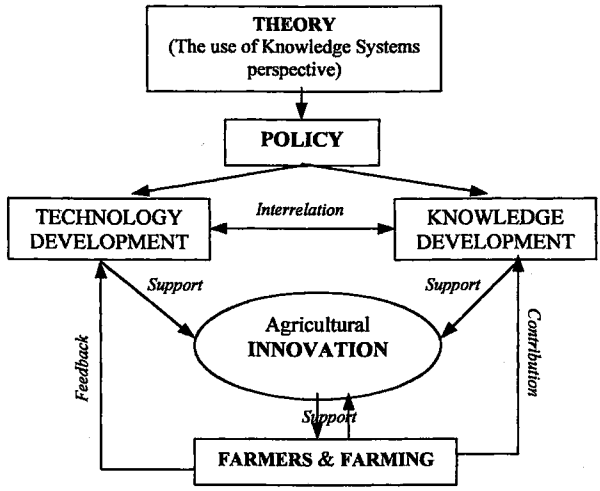


**Figure 10 - Model of Technology Policy based on the situation in the RRD**

As discussed in Chapter 3 (Research Issues), the process of innovation must be viewed as a series of changes in a complete system not only of hardware, but also of market, environment, production facilities and knowledge, and the social context of the innovation organization. Figure 10 presents a "Model of Technology Policy" that is based on the situation in the RRD. In this model, knowledge on the linear model of technology transfer, diffusion of innovations and 'agricultural

treadmill' should be incorporated to inform (underpin) policy. With respect to supporting agricultural innovation, the policy comprises two main components of technology and knowledge development that are inter-related each other. Farming practices, while providing feedback to technology development process, will contribute to the knowledge stock (farmers' participation is reflected by their feedback and contribution to the development of technology and knowledge). Here, technology development is not only the "hardware" or the quantifiable elements of production, but also "knowledge and skills component" of technology. The term knowledge development in this model implies the wider meaning of learning process, such as the one developed by the IPM program to support agricultural innovation.

## V-Implications for policy and practice

The operation of new economic policies in the last decade has created opportunities for farmers to seek new farming systems that hopefully provide better incomes. As mentioned in previous sections, policy-makers see productivity as a core issue for the development of agriculture in the RRD. With respect to crop production, for the time being, rice productivity has gone up considerably and is "reaching its ceiling" as farmers said (see Chapter 5 and 6). Together with increasing rice production in the country during last decade, the price of rice is going down (Chapter 1 and 2). When food insecurity is no longer a problem and there are increasing family' demands on higher living conditions, cash income becomes the major concern of the farmers. In the RRD, many farmers are very interested in planting cash crops while keeping a necessary area of land to produce enough food for family use. In most of districts of the RRD, farmers are still growing rice in "flooding land" that could give room for them to express their innovative ability in farming. In addition, the present situation in the RRD shows that the development of off-farm employment is far from absorbing surplus labor from the agricultural sector. The promotion of farmers' innovation is one of the very important solutions for the development of agriculture in the region. In this sense, diversification plays an important role. However, the new farming systems that have to be developed to realize the goals of the farmers can not be developed at a research institute. This can only be done by innovative farmers, who make use of the available research findings.

In the case of the RRD, there is considerable evidence that farmers have historically responded to market signals by adjusting their cropping patterns and enterprise mixes, unless they were constrained by government policy or by physical, agronomic, financial and market factors. Thus, diversification calls for a broad research effort that includes studies of the economics of production and marketing of alternative crops in various locations and circumstances.

Operationally, the research dimension of diversification reduces to crop-specific endeavors that cover a wide spectrum of alternative crops. Methodologically, this endeavor does not differ from that undertaken for the present principal crops. In setting diversification priorities, cognizance must be taken of the state-of-the-art of growing alternative crops and the need to close the knowledge gap between government officers and farmers. This is an area where the government must play an active role. The essential task of the crop diversification programs is to identify where opportunities for greater return exist, to introduce appropriate policies to make diversification economically attractive and to assist farmers to utilize them. Hence, in addition to research in technology, a realistic policy and market analysis capability is essential.

No matter how many resources are thrown into research, the amount will never be enough. The research network has to have an explicit and transparent system of setting priorities by weight of what the system can achieve in the way of results against the cost of the research, so that the allocation of available resources will be more rational. Past and on-going research in the RRD focus on productivity of food production. But given the fact that problems of very low per capita income still persist in the region and the increasing demand for higher living conditions of farm families, technology development would increasingly have to pay attention to diversification. While the long-term solution to the most populated area like the RRD might be found in sustained expansion of high-paying employment opportunities outside agriculture, the interim solution requires increasing incomes of farmers, enhancing indigenous capacity to manage new farming systems of diversification and promoting farmers' innovation. Just as important as the achievement of efficiency, the prioritization process will force the system to make explicit assumptions about impact of research, so that evaluation of the various research projects can be carried out.

The role of extension is not only to disseminate the stream of new technology coming out of the research system and convey knowledge of the problems actually faced by farmers to feedback to the researchers. The extension system also needs to capture another role, arguably even more important, in facilitating knowledge development and innovation among farming communities. This process is based on IPM principles and approaches that rely on farmers actively participating in the learning processes. These reasons argue for the extension system as not only a channel of communications between farmers and researchers, but also are motive force for facilitating farmers' innovation. Close coordination between research and extension services and farmers is therefore essential.

## VI-Implications for further research

Survey research in different regions of the country should be carried out to generalize the findings. Other research topics could cover aspects of animal husbandry and non-farm employment in rural areas.

Current policy theory suggests that, for regions under similar conditions as the RRD, the development of agriculture must be driven by official technology development. This theory-building research showed that technology contributes only a small part to the development process, farmers' participation is very important and set a foundation for further research about farmers' and official innovations.

## SUMMARY

The RRD has about 1.2 million hectares with 16 millions inhabitants, i.e., its population is about the same size as the Netherlands on an area of land about ¼ the size of the Netherlands. The growth of non-agricultural employment has not yet taken off, so that most of the population growth still needs to be absorbed by agriculture. The average farm size is 0.3 ha and rice growing is obligatory. In recent years, through policy liberalization, adoption of high yielding varieties, fertilizers and other technologies the yield of rice per hectare has increased from about 2 to about 6 tons, or with two crops per year, to 12 tons/ha/annum. This allows farmers to adequately serve their own food needs and a surplus of approximately 200,000 tons in 1999. Farmers see opportunities to develop winter crops (sometimes two winter crops in addition to the two main rice crops are grown), and to reduce their rice acreage in favor of other crops. Given the dynamic situation, the official research and extension system is not always able to effectively respond to farmers' needs.

There are many research and extension projects, but the results are often not successfully applied by farm-households. Meanwhile farmers are busy innovating their farm practices in their search to improve their very low incomes. Somehow the state apparatus is unable to effectively assist farmers in these efforts. This maybe due to the mono-disciplinary research approach and the lack of attention to farmers' needs. Farmers' incomes continue to be low and poverty in rural areas is a concern of both local and national governments. Even with many farming families applying more productive and environmentally sound farming systems, the trend of high costs for production inputs and low prices of outputs prevents them from taking advantage of many opportunities.

With respect to official innovations, the adoption rate has been disappointingly low in many areas, as shown by the expansion of winter crop production or in the case of changing land use systems in the RRD. This is partly because a favorable policy environment in terms of both research and extension is missing. In addition, the contradictions between land, labor, and employment in rural areas are becoming fiercer, inevitably leading to lower incomes. The slow developments of rural industries and services have so far failed to absorb redundant labor from agriculture.

Most agricultural research in Vietnam has understandably been technical in nature. There is very little research of innovation and policy formulation processes. Hence, there has been little reflection on how research and extension organizations interact with farmers to facilitate agricultural development that is sustainable. Few research and extension organizations have formulated clear principles, targets and goals, clear methods of monitoring their impacts, or have established procedures for improving their responsiveness to farmers' needs. The room for research and extension policy choices in practice has been pre-empted by explicit or implicit agricultural policy choices and the specific, local functioning of other forces in rural development, such as market and price of products.

Policy makers remain unaware of the situation in the field and of the barriers to making realistic policies. This results in the lack of enabling policies, and the creation of conditions for sustainable development based on locally available resources, skills and knowledge.

This social problem leads to the following research problem. Official policies are based, whether explicitly or not, on ideas about "what works" in term of stimulating agricultural innovation. These theories can be made explicit and contrasted with an analysis of innovation processes actually taking place in the farming communities. From this comparison it should be possible to formulate more effective theories about innovation to underpin agricultural policy and intervention, and to identify procedures by which state capacity to assist farmers can renew and respond to farmers' needs.

This study uses case studies of innovation processes in the densely populated Red River Delta, and of official models of agricultural innovation, to develop theories to underpin technology (agricultural research and extension) policies of Vietnamese organizations. The overall hypothesis is that the innovation theory currently underpins agricultural technology policy in Vietnam does not adequately reflect the dynamic processes that take place in the field in the context of the (new) open market economic system.

This study aims to look both at (1) farmers' innovation processes, and (2) official innovation theories and efforts, to diagnose the problem identified and suggest more effective policy theories and procedures for supporting farmers' innovation.

The study used a knowledge system perspective to understand needed knowledge and its significance for policy-making in reaching sustainable development of agriculture in the case of RRD. This study is about research as a participatory process, about research *with* people rather than research *on* people. It is about inquiry as a means by which people engage together to explore some significant aspect of policy for technology development and extension, to better understand and contribute to sustainable development of agriculture in the RRD.

**Chapter 1** provides general information about Vietnam and its agriculture in its different agricultural regions, economic situations and agricultural system, policy and institutional reforms, and agricultural research and extension services in the last decade. The information also indicates issues of food security, agricultural diversification, and land-use right in Vietnam. The last section of this chapter concerns government objectives for the development of agriculture and rural economy.

**Chapter 2** provides some more detailed information about the Red River Delta as the region chosen for this study. From this information, the chapter draws social and research problems with hypotheses for the study. Justifications and research objectives are also presented. At the end, the chapter shows a brief of the methodology used in the study.

**Chapter 3** aims to build a theoretical foundation upon which the research is based by reviewing the relevant literature to identify research issues which are worth researching because they are controversial and have not been answered by previous chapters. The chapter discusses the knowledge system perspective and different approaches of technology development and extension. From these discussions, the chapter draws some implications for the study on agricultural innovation and technology policy. Research questions are developed at the end of this chapter.

**Chapter 4** describes the major methodology to collect the data that will be used to answer the hypotheses. In this chapter, qualitative case study methods are presented.

**Chapter 5** briefly presents information from interviewing eighty farmers in different locations of the RRD. The interview has been conducted to understand the realistic conditions of farmers in the region, their opinions and efforts in innovation and what they are expecting from the government's policy. This chapter presents farmers' opinions regarding issues concerning their incomes, innovation, crop protection, sustainability of new farming systems, and research and extension work in the region. This information is a complement to the four case studies to examine what is going on in farmer fields and to explain why farmers try to improve their livelihoods in a different way than the extension service recommends. From this information, the reader can obtain an impression about the situations in the field in order to get a better understanding of the research objectives and hypotheses presented in previous chapters.

**Chapter 6** presents farmers' innovation processes under conditions of scarce resources to deal with problems of low incomes and poverty. In the last decade, farmers in Nam Thanh district have been very active in adapting new technologies to their local conditions and in seeking new ways of farming. Changing land-use systems is one of the activities relating many government policies for agricultural and rural development. Thanh Xa commune (in Nam Thanh district) was chosen as the study site where many farmers are very dynamic and innovative in changing their ways of farming. In this commune, while keeping a necessary land area for planting rice, farmers try to develop new models for horticulture and aquaculture in the farm. These models have shown their advantages, but also contain new challenges to the farmer. The case asks for a good direction or approach to reach sustainability of agricultural development in which, as my point of view, research and extension policies will play an important role. A total of forty farmers were chosen for interview about those issues.

**Chapter 7** presents government efforts in technology development to support winter crop production as a part of the diversification program. Under conditions of the limited land for cultivation as in the RRD, the expansion of winter crop production is seen as one of the strategies for increasing farmers' incomes. The selection of what kind of crop to be planted and what kind of technology to be

applied in the winter season are major concerns of the farmer. In recent years, winter crops are often seen as cash crops. Potato, sweet potato, maize, soybean and many other crops have been introduced to farmers for planting as third crop in the rice-based field. In many cases, these did not provide advantages in terms of money income, good cropping pattern, or productivity. One of the major problems of traditional potato production is the high cost of seed potatoes that result from the loss in a long-time storing period and from disease attack. Many research efforts to improve methods of seed selection and planting practice have been made, but expansion results are still limited. The development of True Potato Seed (TPS) technology is seen as one of the potential solutions for improving farmers' income in the region. That is the reason why the government is now trying to operate quite a big program on the development and expansion of the TPS in the RRD. However, many difficulties emerge with respect to a wide adoption of TPS. The case describes the existing situation and reactions of different groups of farmers to the recommendation of using botanic hybrid seeds instead of traditional tubers in the potato production. The recommendation of TPS-based production gives farmers a chance to get more benefit than with traditional production, but the adoption rate is not as expected by the government. Some farmers have success; others express their reluctance to adopt it. It is expected that if this process is properly developed, more research funds will be available from the government to develop better potato seeds, replacing the old inefficient methods. What are problems of research and extension? Should priority be given to TPS-based production in the RRD? Why do farmers' reactions differ from place to place? etc.

The Integrated Pest Management (IPM) is seen as one good extension method to improve farmers' knowledge on their crop production (**Chapter 8**). Although IPM programs on irrigated rice fields have been introduced since the early 1990's, questions can be still asked whether the campaign satisfy the different interests of farmers in the region. The operation of IPM program represents government efforts to improve farmers' knowledge and practices only in rice production, but the farmers are cultivating many different kinds of crops. The case describes the applicability of IPM in the RRD and how the program has been operating for other crops rather than rice. Growing winter crops (maize, potato, soybean, vegetables, etc.) requires that more inputs are applied, particular chemical inputs, and that the farmer needs to know about these crops and how to protect them. The expansion of winter crop production raises new issues for the sustainability of agriculture in the RRD. In addition, changing to new farming systems, e.g., raised bed systems for the VAC model (Vietnamese farming model, in which V = Garden, A = Fishpond, and C = Animal Shelter) also increases the demand for extension about planting and protecting fruit trees and maintaining sustainability for the model. In recent years, the government has tried to operate an IPM program on potato production in the region. However, this effort seems to face many difficulties and problems of

the potato production itself such as different perceptions of the farmer in making choices between conventional or new seeds, choices with respects to available market of potato seeds and products, etc., and other choices for cropping patterns.

**Chapter 9** presents opinions of different actors in reviewing the government policy in the region through the operation of research and extension programs/projects. Together with reviewing project documents, information was gathered by interviewing government officials (officers working at the ministry), researchers, provincial and district extension workers and farmers. Looking at the process of preparing an agricultural research and extension master plan at different levels (ministries, research and extension organizations), the case tries to clarify official innovation theories and efforts and identify possible ways to improve the process more effectively. The case serves also to examine the prominence currently being attached to the preparation of formal priority-setting procedures as a means to improve the efficiency, as well as the effectiveness, of agricultural research and extension.

**Chapter 10** draws the conclusion that most research and extension programs during last period in the RRD aimed to develop technical measures. Starting point of these ideas was the perception that the scarcity of arable land implies that the development of agriculture in the region must depend on technology. Thus, the increase of productivity was seen as one of most important factors to be targeted at. In recent years, policy-makers saw new technology as the main source of growth for Vietnamese agriculture. That new technology can only be obtained from investment in research. With respect to innovation, government efforts have been made to design the operation of research and extension programs in order to improve crop or animal productivity. However, interventions can be contrasted with an analysis of innovation processes actually taking place in farming communities. In farming communities of the RRD, there is a trend to diversify with a purpose to increase cash incomes as the main strategy of farmers. Farmers have been dynamic in seeking solutions for their low-incomes by planting more cash crops, expanding winter crop production, developing new farming systems, etc. What farmers need are more cash crop system, appropriate technologies for new farming systems and marketing of products. This comparison hopefully provides ideas that make it possible to formulate more effective theories about innovation to underpin agricultural policy and intervention, and to identify procedures by which state capacity to assist farmers can be renewed to better respond to farmers' needs. This chapter also presents implications for theory, policy and practice and for further research.

In the case of the RRD, there is considerable evidence that farmers have historically responded to market signals by adjusting their cropping patterns and enterprise mixes, unless constrained by policy and physical, agronomic, and financial factors. Thus, diversification calls for a broad research effort that includes studies of the economics of production of alternative crops in

various locations and circumstances. Operationally, the research dimension of diversification is reduced to crop-specific endeavors covering a wide spectrum of alternative crops. Methodologically, this endeavor does usually not differ from that undertaken for the customary principal crops. In setting diversification priorities, cognizance must be taken of the state-of-the-art of growing alternative crops and the need to close the knowledge gap. This is an area where the government must play an active role. The essential task of crop diversification programs is to identify opportunities for greater return, to introduce appropriate policies to make diversification economically attractive and to assist farmers to occupy them. Hence, in addition to research in technology a strong policy and market analysis capability is essential.

No matter how many resources are thrown into research, the amount will never be enough. The research network has to have an explicit and transparent system of setting priorities by weighing what the system can achieve in the way of results against the cost of the research, so that the allocation of available resources will be more rational. Past and on-going research in the RRD focuses on productivity of food production. But given the problems of very low incomes per capita that still persist in the region and the increasing demand for higher living conditions by farm families, technology development would have to increasingly pay attention to diversification. While the long-term solution to the densely populated areas such as the RRD might be found in sustained expansion of high-paying employment opportunities outside agriculture, the interim solution requires increasing value incomes of farmers, enhancing indigenous capacity to manage new farming systems allowing diversification and promoting farmers' innovation. Just as important as the achievement of efficiency, the prioritization process will force the system to make explicit assumptions about impact of research, so that evaluation of the various research projects can be carried out. This is an important point, because the danger with most research systems is that it is too easy for scientists to be in their own world without responding to outside developments and needs.

The role of extension is not only to disseminate the stream of new technology coming out of the research system or to convey knowledge of the problems actually faced by farmers as feedback to the researchers. The extension system also needs to capture another role, arguably even more important, in facilitating knowledge development and innovation among farming communities. This process is based on IPM principles and approaches that help farmers to actively participate in learning processes. These argue for the extension system as not only a channel of communications between farmers and researchers, but also a motive force facilitating farmers' innovation. Close coordination amongst research and extension services and farmers is therefore essential.

## SAMENVATTING

De delta van de Rode Rivier in het Noorden van Vietnam heeft een oppervlakte van ongeveer 1,000,000 ha en 16 miljoen inwoners. Er wonen dus ongeveer evenveel mensen als in Nederland op een kwart van de oppervlakte. De groei van de niet-agrarische werkgelegenheid in dit gebied is nog gering, zodat bijna de gehele bevolkingsgroei in de landbouw opgevangen moet worden. De gemiddelde grootte van de landbouwbedrijven is 0.3 ha en de regering verplicht de boeren rijst te telen In de laatste jaren is als gevolg van het beleid van economische liberalisatie en de aanvaarding van hoog opbrengende rijstrassen door de boeren de rijstopbrengst per ha gestegen van 2 tot 6 ton en met twee gewassen per jaar tot 12 ton/ha/jaar. Hierdoor zijn de boeren niet alleen in staat om in de rijstbehoefte van hun gezin te voorzien, maar zelfs om een surplus te produceren (in feite produceerde dit gebied in 1999 een surplus van 200 000 ton). In deze situatie zijn de boeren nog in staat om een derde gewas in de winter te telen naast hun twee rijstoogsten en soms zelfs twee wintergewassen. In deze dynamische situatie zijn het officiële onderzoek en voorlichtingssysteem niet altijd in staat om effectief te reageren op de behoefte van de boeren aan steun bij de ontwikkeling van deze nieuwe gewassen.

Er zijn veel onderzoek en voorlichtingsprojecten, maar de resultaten hiervan worden dikwijls niet met succes toegepast door de boerengezinnen. Tegelijkertijd zijn de boeren druk bezig met het vernieuwen van hun landbouwmethoden in hun zoektocht naar mogelijkheden om hun lage inkomen te verhogen. Het staatsapparaat is echter niet in staat de boeren hierbij op een effectieve wijze te helpen. Het lijkt er op dat dit veroorzaakt wordt door de mono-disciplinaire aanpak van het onderzoek en de geringe aandacht voor de informatiebehoeften van de boeren. Het laag blijvende inkomen van de boeren en de armoede op het platteland vervullen de plaatselijke en nationale overheden met zorg. Zelfs nu veel boerengezinnen overgaan naar bedrijfssystemen met een hogere productiviteit, die ook nog milieuvriendelijk zijn, voorkomt de tendens naar hogere prijzen van de productiemiddelen en lagere prijzen voor de landbouwproducten dat de inkomenssituatie van de boeren verbetert.

De aanvaarding van vernieuwingen, die door de voorlichtingsdienst werden aan bevolen, is vaak teleurstellend laag, zoals bij de uitbreiding van de teelt van gewassen in de winter of de verandering van het systeem van grondgebruik. Dit komt ten dele doordat de boeren hierbij weinig steun kregen van zowel onderzoek als voorlichting of door middel van subsidies. De langzame ontwikkeling van industrie en diensten in de plattelandsgebieden was ook niet in staat de arbeidskrachten, die in de landbouw overtollige waren geworden, op te nemen.

Het is begrijpelijk dat in Vietnam het landbouwkundig onderzoek grotendeels technisch van aard is. Er is heel weinig onderzoek over innovatie- en beleidsprocessen. Derhalve wordt er ook weinig nagedacht over het samenspel tussen de onderzoek en voorlichtingsorganisaties en de boeren om een duurzame landbouwontwikkeling te faciliteren. Weinig onderzoek en voorlichtingsorganisaties hebben duidelijk geformuleerde principes en doelen, duidelijke methoden om hun effecten te monitoren of vaste procedures om hun ontvankelijkheid voor de informatiebehoeften van de boeren te verbeteren. De ruimte die het onderzoek en de voorlichting hebben om beleidskeuzen te maken wordt in de praktijk beperkt door de expliciete en impliciete keuzen in het landbouw ontwikkelingsbeleid en het functioneren van andere krachten, die de locale ontwikkeling beïnvloeden, zoals de markt voor en de prijzen van de producten. De beleidsmakers zijn zich niet goed bewust van de situatie in het veld en de barrières die het maken van een realistisch beleid belemmeren. Dit resulteert in een gebrek aan een beleid dat mogelijkheden en voorwaarden schept voor een duurzame ontwikkeling, die gebaseerd is op de ter plaatse beschikbare hulpbronnen, vaardigheden en kennis.

Dit sociale probleem heeft ons er toe gebracht het volgende onderzoeksprobleem te formuleren. Overheidsbeleid is gebaseerd, al dan niet expliciet, op ideeën over "wat werkt" in termen van bevordering van vernieuwing in de landbouw. Deze theorieën kunnen expliciet gemaakt worden en dan vergeleken worden met een analyse van de innovatieprocessen, zoals die in feite in de dorpen plaats vinden. Vanuit deze vergelijking hopen we dat het mogelijk zal zijn meer effectieve theorieën te formuleren van vernieuwingsprocessen die de basis vormen van het landbouwbeleid en de interventies van de overheid en het identificeren van procedures om de capaciteit van de overheid te vernieuwen om boeren te helpen en in te spelen op hun behoeften.

Dit onderzoek gebruikt case studies van innovatieprocessen in de dicht bevolkte delta van de Rode Rivier en van de modellen van vernieuwing in de landbouw, waarop het technologiebeleid (onderzoek en voorlichting) van Vietnamese organisaties is gebaseerd. De voornaamste hypothese is dat de innovatietheorie die in Vietnam het huidige technologiebeleid onderbouwt, de dynamische processen die in het veld plaats vinden in de context van het (nieuwe) open markt economisch systeem, niet adequaat weer geeft.

Het doel van deze studie is zowel te kijken naar (1) de innovatieprocessen van de boeren als naar (2) de officiële innovatietheorieën en inspanningen, als te helpen een diagnose te maken van het geïdentificeerde probleem, ten einde meer effectieve beleidstheorieën en procedures voor te stellen ter ondersteuning van de innovatie door boeren.

Deze studie maakt gebruik van het kennissysteem perspectief om te begrijpen welke kennis nodig is en wat de betekenis hiervan is voor het formuleren van een beleid dat gericht is op het

bereiken van een duurzame landbouwontwikkeling in de delta van de Rode Rivier. Deze studie gaat over onderzoek als een participatief proces, over onderzoek met de mensen in plaats van onderzoek voor de mensen. Het gaat over het verzamelen van informatie als een middel om mensen te betrekken bij het gezamenlijk exploreren van belangrijke aspecten van het technologiebeleid en bij te dragen tot een duurzame ontwikkeling van de landbouw in de delta van de Rode Rivier.

**Hoofdstuk 1** geeft algemene informatie over Vietnam en de landbouw in de verschillende regios, de economische en landbouwkundige situatie, het overheidsbeleid en de institutionele hervormingen en het landbouwkundig onderzoek en de voorlichting in de laatste tien jaar. Ook wordt informatie gegeven over voedselzekerheid, de diversificatie van de landbouw en de grondrechten in Vietnam. Het laatste deel van dit hoofdstuk heeft betrekking op de doelen van het overheidsbeleid t.a.v. de landbouwontwikkeling en de economie van het platteland.

**Hoofdstuk 2** voorziet in meer gedetailleerde informatie over de delta van de Rode Rivier, die als onderzoeksgebied voor deze studie is gekozen. Op basis van deze informatie presenteert dit hoofdstuk sociale en onderzoeksproblemen en hypothesen voor het onderzoek. Rechtvaardigingen van de gemaakte keuzen en doelen van het onderzoek worden ook gepresenteerd. Tot slot geven we een kort overzicht van de gebruikte onderzoeksmethodiek.

**Hoofdstuk 3** geeft een theoretische fundering van het onderzoek Deze is gebaseerd op een overzicht van de relevante literatuur om de onderzoeksproblemen te identificeren die het waard zijn nader onderzocht te worden, omdat zij controversieel zijn of niet beantwoord zijn in de voorgaande hoofdstukken. Besproken worden het kennissysteem perspectief en verschillende benaderingen voor technologie ontwikkeling en voorlichting. Hieruit volgen gevolgtrekkingen voor het onderzoek naar vernieuwing in de landbouw en technologiebeleid. Tot slot worden onderzoeksvragen geformuleerd.

**Hoofdstuk 4** beschrijft de voornaamste methoden die gebruikt zijn om de gegevens te verzamelen, die nodig zijn om de hypothesen te toetsen. Ook worden de kwalitatieve methoden gepresenteerd, die in de case studies gebruikt zijn.

**Hoofdstuk 5** geeft een kort overzicht van de informatie die verkregen is door 80 boeren uit verschillende locaties te interviewen. Deze interviews zijn uitgevoerd om begrip te krijgen van de werkelijke omstandigheden van de boeren in deze regio, hun meningen en hun inspanning om hun bedrijfsvoering te vernieuwen en hun verwachtingen t.a.v. het overheidsbeleid. We geven een beeld van de mening van de boeren t.a.v. hun inkomen, vernieuwingen, bestrijding van plantenziekten, duurzaamheid van nieuwe bedrijfsystemen en het landbouwkundig onderzoek en voorlichting in hun gebied. Deze informatie is een aanvulling op de vier case studies om te onderzoeken wat er plaats vindt in het veld en uit te leggen waarom boeren hun levensomstandigheden trachten te

verbeteren op een andere wijze dan de voorlichting hen aanraadt. Uit deze informatie krijgt de lezer een idee van de bestaande situatie in het veld teneinde de onderzoeksdoelen en hypothesen, die in de voorgaande hoofdstukken zijn weer gegeven, beter te begrijpen.

**Hoofdstuk 6** beschrijft het innovatieproces van de boeren onder omstandigheden waarin zij over weinig hulpbronnen beschikken voor de oplossing van de problemen van een laag inkomen en armoede. In de laatste decade zijn de boeren in Nam Thanh district zeer actief geweest om nieuwe technologieën aan te passen aan de omstandigheden ter plaatse om hun bedrijfsvoering te veranderen. Verandering van het systeem van grondgebruik is een van de activiteiten die verband houdt met het overheidsbeleid tan aanzien van de ontwikkeling van landbouw en platteland. Thanh Xa commune (in Nam Thanh district) is gekozen als locatie voor dit onderzoek. De boeren zijn hier zeer actief bezig om nieuwe technologieën aan te passen aan locale omstandigheden en met het zoeken van nieuwe methoden om hun bedrijf te voeren. In deze commune trachten boeren nieuwe modellen van tuinbouw en aquacultuur in te passen in hun bedrijfsvoering, terwijl zij voldoende rijst blijven telen voor eigen gebruik. Deze modellen blijken voordelen te hebben, maar zij plaatsen de boeren ook voor nieuwe uitdagingen. Deze case laat zien dat de juiste benadering gekozen moet worden om een duurzaam bedrijfssysteem te ontwikkelen waarin, naar mijn mening, het onderzoek- en voorlichtingsbeleid een belangrijke rol speelt. Over deze vragen hebben we 40 boeren geïnterviewd.

**Hoofdstuk 7** beschrijft de inspanningen van de overheid om technologieën te ontwikkelen voor de teelt van gewassen in de winter als onderdeel van het programma voor diversificatie van gewassen. Onder de omstandigheden in de delta, waar weinig cultuurgrond beschikbaar is, wordt de uitbreiding van de teelt van gewassen in de winter gezien als een strategie om het inkomen van de boeren te vergroten. De keuzen van welk gewas geteeld zal worden en welk technologie hierbij toegepast zal worden, zijn voor de boer van veel belang. De laatste tijd worden deze wintergewassen vaak gezien als handelsgewassen. Zoete aardappelen, maïs, sojabonen, aardappelen en tal van andere gewassen zijn ingevoerd in dit gebied als derde gewas in een op rijstteelt gebaseerd bedrijfssysteem. In veel gevallen leverden deze gewassen geen voordeel op in termen van geld inkomen, gewasrotatie of productiviteit. Bij de traditionele wijze om aardappelen te telen vormen de hoge kosten van het pootgoed ten gevolgen van verliezen in de lange bewaartijd en van ziekten, een belangrijk probleem. Het onderzoek heeft zich sterk in gespannen om betere methoden te ontwikkelen om pootgoed te selecteren en te telen, maar de resultaten worden slechts op beperkte schaal toegepast. De ontwikkeling van True Potato Seed (TPS) wordt gezien als een potentiële mogelijkheid om het inkomen van de boeren in dit gebied te verbeteren. Daarom tracht de regering nu een groot programma uit te voeren voor de toepassing van dit TPS in de delta van de

Rode Rivier. Er zijn echter veel moeilijkheden om te bereiken dat deze teelt op grote schaal wordt toegepast. De case beschrijft de bestaande situatie en het gedrag van verschillende groepen boeren t.a.v. de aanbeveling om in de aardappelteelt botanisch hybride zaad te gebruiken in plaats van de traditionele knollen. De aanbeveling om een op TPS gebaseerd productiesysteem toe te passen geeft de boeren een kans om meer te verdienen dan met het traditionele productiesysteem, maar boeren passen dit nieuwe productiesysteem veel minder toe dan de regering verwachtte. Sommige boeren hebben er succes mee, maar anderen hebben weerstanden om op deze methode over te stappen. De projectleider verwacht dat als het project voor bevordering van het TPS goed wordt uitgevoerd de regering meer fondsen beschikbaar zal stellen voor onderzoek om betere aardappel zaden te ontwikkelen, die de oude, inefficiënte methoden kunnen vervangen. Wat zijn de problemen van onderzoek en voorlichting? Moet prioriteit gegeven worden aan het gebruik van TPS in de delta? Waarom verschillen de reacties van de boeren van plaats tot plaats? Enz.

Integrated Pest Management (IPM) wordt gezien als een goede voorlichtingsmethode om de kennis van boeren over gewasproductie te vergroten (**Hoofdstuk 8**). Alhoewel IPM programma op geïrrigeerde rijstvelden sinds het begin van de negentiger jaren worden toegepast, is het toch nog de vraag wat de resultaten hiervan zijn bij boeren met verschillende belangen in dit gebied. De regering heeft zich alleen maar ingespannen om via het IPM programma de kennis van de boeren van rijstproductie en de methoden die zij hierbij toepassen, te verbeteren, maar de boeren telen ook allerlei andere gewassen. Deze case beschrijft de toepasbaarheid van IPM in de delta van de Rode Rivier en hoe dit programma wordt uitgevoerd voor andere gewassen dan rijst. De teelt van wintergewassen (maïs, aardappelen, sojabonen, groenten, enz.) vereist dat meer productiemiddelen worden gebruikt, in het bijzonder chemische middelen en dat boeren kennis hebben van de teelt van deze gewassen en van de mogelijkheden om ze tegen ziekten te beschermen. De uitbreiding van de teelt van wintergewassen doet vragen rijzen over de duurzaamheid van de bedrijfssystemen in dit gebied. Bovendien doet de overgang naar nieuwe bedrijfssystemen (b.v. systemen met verhoogde bedden in het model waarin tuinbouw, visteelt en veehouderij gecombineerd worden) de vraag toenemen naar voorlichting over fruitteelt en de ziektebestrijding in deze teelt en over de mogelijkheden om de duurzaamheid van dit model te handhaven. De laatste jaren heeft de regering getracht een IPM programma voor de aardappelteelt in dit gebied uit te voeren. Het schijnt echter, dat deze inspanningen te maken krijgen met moeilijkheden en problemen in de aardappelteelt, zoals de verschillende wijzen waarop boeren de gevolgen van conventionele methoden en van de nieuwe zaden waarnemen, de beschikbaarheid van een markt voor aardappelzaden en andere keuzen in de gewasrotatie.

**Hoofdstuk 9** geeft de meningen van verschillende actoren weer over de uitvoering van onderzoek en voorlichting programma en projecten van de overheid in dit gebied. Informatie hierover is verkregen door de analyse van projectdocumenten en interviews met beleidsambtenaren op het ministerie van landbouw, onderzoekers, voorlichters op provinciaal en district niveau en boeren. Door te kijken naar het proces van de voorbereiding van een meester plan voor onderzoek en voorlichting op verschillende niveaus (ministeries, onderzoek- en voorlichtingsorganisaties) trachtten we een helder beeld te krijgen van de innovatietheorieën, waarvan men uit is gegaan, van de inspanningen op dit gebied en van mogelijke wijzen om verbeteringen in het innovatieproces te identificeren. Met deze case trachtten we ook te onderzoeken welke betekenis werd gehecht aan de voorbereiding van formele procedures voor het bepalen van prioriteiten als middel om de efficiency en de effectiviteit van het landbouwkundig onderzoek en de voorlichting te vergroten.

**Hoofdstuk 10** trekt de conclusie dat de laatste tijd de meeste onderzoek en voorlichting programma's in de delta van de Rode Rivier gericht zijn geweest op het ontwikkelen van technische maatregelen. Het uitgangspunt van deze ideeën was dat door de schaarste aan cultuurgrond de ontwikkeling van de landbouw in dit gebied afhankelijk was van de gebruikte technologie. Derhalve werd een toename in de productiviteit gezien als een van de belangrijkste factoren waarop de programma gericht moesten worden. In recente jaren zagen beleidsmakers nieuwe technologieën als de voornaamste bron van groei in de Vietnamese landbouw. Deze nieuwe technologie kon alleen ontwikkeld worden door investering in onderzoek. Met betrekking tot innovatie waren de inspanning van de overheid gericht op het ontwerpen en uitvoeren van onderzoek en voorlichting programma's om de productiviteit van gewassen en vee te verhogen. Deze interventies kunnen echter vergeleken worden met een analyse van het innovatieproces, zoals dat in feite plaats vindt in de boerengemeenschappen. In deze gemeenschappen in de delta is de voornaamste strategie van de boeren een poging tot diversificatie met als doel meer geld te verdienen. Op een dynamische wijze zoeken de boeren naar oplossingen voor het probleem van hun lage inkomen door meer handelsgewassen te telen, de gewassen teelt in de winter uit te breiden, nieuwe bedrijfssystemen te ontwikkelen, enz. Waar de boeren behoefte aan hebben, is een bedrijfssysteem dat meer gericht is op de teelt van handelsgewassen, aan hun situatie aangepaste technologieën voor de teelt van deze gewassen en een goed systeem voor de afzet van deze producten. Hopelijk verschaft deze vergelijking mogelijkheden om effectievere theorieën over innovatie te ontwikkelen ter ondersteuning van het landbouwbeleid en de keuze van interventies en bij het ontwikkelen van betere procedures, waarmee de overheid boeren kan helpen inzichten te verwerven waaraan zij behoefte hebben. Dit hoofdstuk geeft implicaties van deze gedachtegang voor theorie, beleid en de uitvoering van dit beleid en voor verder onderzoek.

In het geval van de delta van de Rode Rivier zijn er heel wat bewijzen dat boeren in het verleden hebben gereageerd op signalen uit de markt door aanpassing van de keuze van gewassen en de combinatie van bedrijfstakken, tenzij zij daarin beperkt werden door het beleid van de overheid en door fysieke, agronomische of financiële factoren. Diversificatie vereist derhalve een brede inspanning van het onderzoek, waarbij aandacht wordt gegeven aan de economische gevolgen van de keuze van verschillende gewassen in verschillende locaties en omstandigheden. Operationeel is het onderzoek gericht op diversificatie van gewassen beperkt door zich te richten op een breed spectrum van verschillende mogelijke gewassen. Methodisch gezien wijkt deze aanpak van het onderzoek niet af van het onderzoek zoals dat gewoonlijk gedaan wordt over enkele hoofdgewassen. Bij het vaststellen van prioriteiten voor diversificatie moet kennis genomen worden van de stand van zaken t.a.v. de kennis van de teelt van verschillende mogelijke gewassen en van de noodzaak de kenniskloof op dit gebied te sluiten. Op dit gebied moet de overheid een actieve rol spelen. De voornaamste taak van een programma voor diversificatie van de gewassenkeuze is het identificeren van de mogelijkheden om een groter inkomen te verwerven, het introduceren van geschikte beleidsmaatregelen om deze diversificatie economisch aantrekkelijk te maken en het assisteren van boeren bij realisatie van deze mogelijkheden. Derhalve is het essentieel dat naast goed technologisch onderzoek de capaciteit ontwikkeld wordt om beleid- en marktanalyses te maken.

Ongeacht hoeveel hulpbronnen beschikbaar zijn voor onderzoek, er zal nooit voldoende zijn. Het onderzoekssysteem moet een duidelijke en transparante methode hebben om prioriteiten te stellen door de resultaten die mogelijk bereikt kunnen worden af te wegen tegen de kosten van het onderzoek, zodat een meer rationele allocatie van de beschikbare hulpbronnen mogelijk wordt. In het verleden en in het heden is het onderzoek in de delta van de Rode Rivier gericht op het verhogen van de opbrengsten per ha. Maar gezien het probleem van het zeer lage inkomen per hoofd van de bevolking en de toenemende wens van de boerengezinnen om hun levensomstandigheden te verbeteren, zal de ontwikkeling van nieuwe technologieën zich in toenemende mate moeten richten op diversificatie. Op lange termijn kunnen we hopen dat in dicht bevolkte gebieden zoals de delta van de Rode Rivier de werkgelegenheid buiten de landbouw toeneemt. Een interim oplossing vereist een toename van de waarde van de landbouwproductie door het vergroten van de capaciteit van de boeren om gediversifieerde bedrijfssystemen te beheren en de innovatie door de boeren zelf te bevorderen. Even belangrijk als de vergroting van de efficiency van onderzoek en voorlichting, is het proces van het stellen van prioriteiten dat het systeem noodzaakt duidelijke veronderstellingen te maken over de invloed van het onderzoek, zodat een evaluatie van de verschillende onderzoeksprojecten mogelijk wordt. Dit is een belangrijk

punt, omdat een gevaar in de meeste onderzoekssystemen is dat de onderzoekers de neiging hebben binnen hun eigen wereld te blijven zonder te reageren op nieuwe ontwikkelingen en behoeften.

De rol van voorlichting is niet alleen om de nieuwe technologieën, die uit het onderzoek komen, te verspreiden of om feedback te verschaffen aan de onderzoekers door hen te informeren over de problemen waarmee de boeren geconfronteerd worden. Het voorlichtingssysteem moet ook een andere rol vervullen, die men zelfs als belangrijker kan beschouwen, door de ontwikkeling van kennis en innovaties in boerengemeenschappen te bevorderen. Dit proces is gebaseerd op de principes van IPM en op benaderingen die boeren helpen actief deel te nemen aan leerprocessen. Deze redenen geven argumenten voor het ontwikkelen van een voorlichtingssysteem dat niet alleen een communicatiekanaal is tussen boeren en voorlichters, maar dat ook een motiverende kracht is om innovatie door boeren te faciliteren. Hiervoor is het essentieel dat er een nauwe coördinatie bestaat tussen het onderzoek- en voorlichtingssysteem en de boeren.

## CURRICULUM VITAE

Nguyen Van Linh was born on August 19th 1956, in Hai Duong province, Vietnam as a farmers' son. He received his B.Sc. in agricultural economics at Hanoi National Economic University, Vietnam in 1978. From 1978 to 1989, he worked for Vietnam Agricultural Sciences Institute (VASI) as officer in the Department of Planning and Scientific Management. In this position, he took part in the responsibility for designing and monitoring VASI projects on agricultural research and transfer of technologies. He participated in a short training course on Farming System Research and Extension organized by IRRI in the Philippines during period of July to November 1989. Since 1989, he has worked as a researcher of the Farming Systems Research and Extension Department, VASI. He was engaged in some research projects on income generating activities of farmers' households that were carried out in northern provinces of Vietnam. He worked as a secretary for a research project on Cropping Systems in Red River Delta and Northern Coastal Regions from 1991 until July 1994.

From August 1994 to February 1996 he did his MSc. in the Management of Agricultural Knowledge Systems (MAKS), of Wageningen University, The Netherlands. He specialized in training and extension. He completed a MSc. thesis on *"The interaction between Farmers' and Scientists' Knowledge in the Development Process"*. He continued working for VASI after graduating from the MSc. program as researcher in the Farming Systems Research and Extension Department until August 1997. During this time, he also worked as consultant on rural development projects for some international non-government organizations in Vietnam such as GRET, Plan International, Oxfam Belgium, Oxfam HongKong, Finnish Terra Oriens, and CCF Australia.

Since September 1997 to 2001 he worked on a "sandwich" Ph.D. program in cooperation with the chair group Communication and Innovation Studies (Wageningen University, the Netherlands) and VASI (Vietnam), for his Ph.D. thesis on Agricultural Innovation in the Red River Delta of Vietnam. Currently, he is working as a senior researcher at VASI and consultant for GRET in implementing farming system research projects in the Red River Basin in Vietnam.

**ANNEX**

**INTERVIEW GUIDE (As semi-structured questionnaire for the interview on farmers' innovation and assessments to agricultural technology development and extension in the RRD)**

*Questionnaire number...*
*Village...*
*Name of respondent (or head of household)...*
*Age... Sex (male/female), Education...*
*Number of family members...*
*Date of interview...*

**I-Current economic conditions of household**

I.1-Land: Total area (m2)...

- Number of plots...
- Current cropping patterns...
  - Areas of rice field (m2)...
  - Areas registered as "flooding land" (m2)...
  - Areas of new farming systems (m2)...
  - Areas of winter crops (m2)...
    - Potatoes (m2)...(winter?)
    - Maize (m2)...
    - Vegetables (m2)...
    - Others...
- Area of home garden (m2)...
- Area of fish pond (m2)...
- Why some areas are not cultivated in winter season?
- Why some areas are not changed for new systems?

I.2-Irrigation conditions (good, normal, poor):

- Condition of whole farm? For winter crops?
- Conditions before and after changing land-use systems?

I.3-Income sources before and after changing to new farming systems (total = 100%)

- From crop production ...(%), counted for specific crop (rice, potato, and others)
- From animal raising ...(%)
- From horticulture/home garden ...(%)
- From new farming systems ...(%)
- Others ...(%)

I.4-Proportion of total products for sale (%):

- Total rice sold in comparison with total production?

* Total potato sold in comparison with total production?

I.5-Average of family income compared with other farmers in the village: (good, middle, poor)

I.6-Family labor: (lack of, enough, surplus)

* If lack of/surplus family labor, what are solutions?

I.7-Problems/difficulties

**II-Farmers & official innovations**

II.1- What kinds of innovations (new technologies) have been applied by family's members in last five years?

* On crop production (new varieties of rice, potato, maize, others)...
* On animal raising (new breed, changes in feeding methods, caring, shelter, etc.)...
* Other activities...

II.2-Where is information about innovations come from?

* Extension agencies
* Research stations
* Mass media
* Relatives
* Other farmers
* Commercial agents
* Others

II.3-Why is the innovation chosen? What are criteria of the choice? (This question can be asked for different innovations)

II.4-Who in your family decided to apply/reject innovations?

II.5-Please estimate how many per cent farmers in the village (someone who have the same conditions) already applied that innovation before you decide to choose? (%)...

* <10%
* 10-30%
* 30-50%
* >50%
* Unknown

II.6-Government subsidy for application of innovation? If any, Why?

II.7-Benefits from that application:

* The market is available for those products?
* The cost and price per unit of product at the time before and after you apply innovations:

  +Costs down, price is stable;
  +Costs down, price is slightly down;
  +Costs down, price raised;
  +Costs are stable, price raised;
  +etc.

**III-Farmers with information flows and learning process**

III.1-The time of first hearing about innovation

* When did you hear about it?
* From whom?
* Where does it come from?
* Level of interest: (very strong, strong, normal, weak, very weak)
* Ways of your response to that information (e.g., looking to learn more about it, trial it, discuss with others, etc.) and why did you do like that?

III.2-The time of first application

* Size of the first application... Why did you apply at that size?
* The results? (That were expected or not?), and Why?
* Ways of your response to that results (learning more, try again, expanding the size, stop it, etc.), and Why?
* The same above question for true seed potato production.

**IV-Farmers & IPM program**

IV.1-For someone who participate in the program:

* From whom did you get information about IPM program?
* When?
* You are in first (second, etc.) group participated the program? ... Why?
* Why did you participate in the program?
* Estimate benefits from the program: reducing inputs applied, and get the former, same or higher outputs/incomes, learnt more about production techniques and technologies?

IV.2-For someone who does not participate:

* Why not participate?

**V-Farmers & research and extension programs**

* Do you know something about R&E programs operating in your village and district?
* Did you participate (and level of participation) in that program? Why?
* What do you expect from the program?
* Which benefits did you get from participating in the program? Why?
* Strong/weakness points of those program to help you and other farmers in the village?
* Do you know R & E policies (or plans, directions, programs as terms used by farmers) from Government applied in your region, district?
* Your opinions about that policies? (Discuss each government direction for research and extension program)
* How can government improve the policy that relevant/suit to your conditions and support your innovation?
* Other opinions?

**VI-Other opinions**

CIP-DATA KONINKLIJKE BIBLIOTHEEK, Den Haag, The Netherlands

Linh, Nguyen Van

Agricultural Innovation - Multiple grounds for technology policies in the Red River Delta of Vietnam.

Ph.D. Thesis Wageningen University. With summaries in English and Dutch.

ISBN: 90-5808-387-X

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