

CHAPTER 1

PURPOSE

This thesis researches possibilities for small-scale Vietnamese farmers to intensify land use through integration of diversified product mixes. Such intensification is made necessary by growing population numbers who find neither alternative employment opportunities outside their rural communities nor new land to cultivate. Intensified production will allow farm families to make a living off the land until Vietnam's economy can grow and absorb agricultural surplus labor through the natural process of efficiency increases. The paper argues that traditional production can be improved within the framework of small farms and using methods farmers are accustomed to. The paper concludes that these methods, practiced sustainably for centuries, should be maintained based on their positive impact on labor absorption, the associated poverty alleviation and environmental sustainability.

1.2. Themes

The following themes are relevant to this study:

- Environment
- Sustainability
- Trade and Globalization
- Technology
- Distribution and Equity

- *Environment*

Robin Broad and John Cavanagh argue that contrary to the often-heard notion that the poor are responsible for environmental problems through their destructive behavior in making a living off the land, they instead tend to be the most ardent defenders of the environment. The poor tend to depend on their environment more directly than wealthier groups in society. Thus, they are the first to stand up to destruction, which is often caused by rapid resource utilization by the wealthy elites. Collusion between economic, military and political groups creates a powerful entity that dominates entire national economies. While the wealthy exploit their environment, the poor use it. When these two views on the environment clash, the poor will stand up for their environment in a way they would not challenge the power structures over other issues, such as freedom, democracy or other values — not for the sake of a belief or a principle, but for survival (Broad & Cavanagh 1988, 1993, Broad 1995).

By contrast, Gene Grossman says that wealth is a prerequisite for environmental protection. He finds in a study that once national income reaches a certain level (\$5,000 per capita — he does not mention the value in purchasing power parities), key indicators for air pollution are reduced, with or without government regulations. The reason for this fact, according to Grossman, lies in the ability to obtain better technologies and shifting priorities. The environment is seen as necessary for the quality of life and protected as such, rather than being a tool to satisfy basic needs for survival. In his view, wealth begets environmentalism (Grossman 1990).

Justin Ward and Jared Blumenfeld focus their discussion the problems of agricultural subsidies and their impact on the environment. In 1990 alone, they find,

O.E.C.D. countries spent \$299 billion on subsidies for their agricultural sectors. These subsidies foster production systems that go beyond their ecological limits while leading to pollution from chemical inputs, such as run-off and eutrophication. And where agriculture is regulated by law, corporate producers manage to externalize the environmental cost by shifting production into the Third World. Thus, agricultural subsidies and trade regimes create price distortions through the externalization of environmental costs. This underpricing of agricultural products leads to overproduction and overconsumption and the associated environmental problems (Blumenfeld et. alt. 1993, Ward & Blumenfeld 1994).

— The authors are highly relevant to the research in this paper, as Vietnam is in the process of becoming an export zone for agricultural products, including fish and shrimp. International corporations in conjunction with local elites are controlling the export of cash crops, although they are leaving production (and the associated risks) to small farmers. The environmental impact of these changes in agriculture is one of the main points of research of this thesis.

- *Sustainability*

David Korten looks at sustainability of growth-based development models and finds these models lacking. According to Korten, development means transformation, not growth. Once humans have used up the ecological niche available to them (and Korten believes that point has been reached), the only way to develop further is to switch to sustainable sectors, such as services. Korten says that the industrialization of the First World brought with it a broad social disintegration, and these negative side-effects of “growth” can already be seen in Third World countries as well. The spoils of growth

always accrue to the elites. They deplete the natural resources the poor need for survival for their excessive gains. This strategy of development, rapid resource depletion, is colonial in nature and depends on ever-expanding frontiers — an inherently unrealistic assumption (Korten 1990 1992).

Helena Norberg-Hodge criticizes the unsustainable economic model that allows cost externalization so that inherently inefficient processes become profitable. She finds that one serving of yogurt, all ingredients of which could be found within a 50-mile radius from the average American consumer, travels 7,000 miles. This is thanks to free roads and no cost on the environmental destruction of fossil fuel burning. Shortening the links between producer and consumer would change this unsustainable situation, and give the consumer more of a say over the products consumed (Norberg-Hodge, Goering & Page 1993, Norberg-Hodge 1994).

Broad, Cavanagh and Walden Bello look at development “success stories” and evaluate their sustainability. They come to the conclusion that South Korea and Taiwan, if looked at through a long-term lens, are not as worthy of emulation as they are often made out to be. Only rapid resource extraction at an unsustainable rate or production at pollution rates beyond what the environment is capable of absorbing allowed these economies to improve their economic situation rapidly, and many indicators show that the situation is reversing itself, as sustainability limits are reached (the authors published their work before the Asian financial crisis) (Broad, Cavanagh & Bello 1991).

— Vietnam’s rural sector — under study here — is bound to grow and export at a high rate in the near future. It is important to plan for sustainable development, although growth will certainly be part of the changes. Initial problems have shown risks for

sustainability as described by the authors, and experiences in the aquaculture sector in other Southeast Asian countries point towards more trouble on the horizon, if the sustainability issues cannot be addressed early on in the rural development process.

• *Trade and Globalization*

In an increasingly intertwined global trade regime, trade has a large impact on development. Jagdish Bhagwati writes that restrictions on free trade breed inefficiencies and distortions that lead in further consequence to the unsustainable and environmentally damaging activities described by other authors in this survey. By harming the economy, these distortions also have a negative effect on human embetterment itself. Bhagwati adds another aspect to the notion that growth is beneficial to the environment and development for all. He argues that the national wealth that comes from growth — tax revenues — can be used for social services and environmental improvements. Despite his free market leanings, Bhagwati believes that government remains necessary to create a framework for development. He says that many socially profitable investments are not undertaken by the private sector, as the time horizon is too long to attract venture capital. Thus, growth and the increased capital flows to government are a necessary prerequisite for development (Bhagwati 1993, Bhagwati & Hudec 1996).

On the other side of the issue, Herman Daly says growth increases the environmental costs faster than the benefits of production, thus making us poorer in the long run instead of richer. Daly also takes strong issue with the notion of “free trade,” arguing that once a country has fully developed its comparative advantage in certain sectors and focused its economy towards these sectors, the country is no longer free not to trade, due to its dependence on these sectors and the subsequent reliance on imports of

products from outside these focus sectors. As for trade between First and Third World nations, Daly fears that the First World is attaining cheapness at the expense of efficiency. He advocates cost internalization in order to account in full for all costs, social, environmental etc., of production. By moving industries into countries with lax environmental or non-existent worker protection, the First World creates underpriced goods. As proof of the inefficiencies of free trade regimes, Daly says that more than half of the world's trade flows involve products imported as well as exported by the same country (Daly 1991, 1993, Daly & Townsend 1993).

Hilary French criticizes free trade regimes for undercutting Third World farming. She says free trade agreements tend to allow the sale of subsidized (either directly or through cost externalization) First World products onto Third World markets. Although working at very low cost, the small-scale farmer cannot compete with the highly mechanized corporate agricultural producer. On the other hand, French says, where free trade agreements actually eliminate subsidies, they could create a situation where the true cost advantage of the Third World farmer allows exports into First World markets (French 1993).

— Vietnam is engaging in the development of export agricultural production, and trade issues are of the highest importance. Vietnamese farmers indeed enjoy a competitive advantage in the production of many traditional products, such as rice, fish and shrimp. If trade is truly free and untainted by subsidies, it could help Vietnam's exporters to capture First World markets.

- *Technology*

The biotechnology revolution is set to write in stone the domination of the First World, says Henk Hobbelink. Research undertaken primarily for profit by private corporations will naturally focus on markets rather than on the needy, thus centering on mass consumer goods. Seeds will be purely bought and sold, with no heed paid to the needs of the poor. Diversity, Hobbelink says, is a hindrance under the mass production scenario. But corporate farmers forget that diversity also reduces the risk of total failure and creates blocks for pathogen pathways. To avoid the problems that come with monoculture, ever-more capital intensive technological solutions will be needed. Under this scenario, agricultural production and profits will be concentrated in the hands of the few who can afford these technologies, while the mass of poor farmers will find itself as hired hands or migrants to the urban centers (Hobbelink 1991).

In this vein, Frances Stewart and Ejaz Ghani argue that a country should decide what development path to take in the long run before investing in the technologies, rather than adopting the latest technologies and have its development path dictated by them. Development encompasses more than a choice of production and the technologies used to produce. It also requires decisions on distribution of wealth, modes of production, political choices etc. These choices can be severely limited if a country adopts a certain technology path early on in its development (Stewart & Ghani 1986).

In addition, Nurul Islam points out that mechanical technologies are not scale-neutral, thus favoring large farmers over small. However, Islam believes that the cost of biotechnology per unit produced is equal. Consequently, small farmers could benefit, provided that the technologies trickle down to the farmers at the bottom of the income scale (Islam 1988).

— Technology is changing slowly in Vietnam, as farmers are reluctant to adopt unknown tools and techniques. But with the necessary intensification this paper describes, changes are inevitable and already visible. Thus, the issue of appropriate technologies is paramount for Vietnam's development.

• *Distribution and Equity*

Development does not only mean more money, but also the entitlement to obtain goods and services for that money, says Amartya Sen. If farm communities grow richer, but still lack the opportunity to send their children to school, because there is no school nearby, they have not really developed, according to Sen. Development economics has failed to focus on this aspect of development, as it was primarily concerned with growth and the distribution of wealth, not the availability and distribution of entitlements. Growth matters, but only as a means to achieve other goals, Sen says (Sen & Drèze 1991, Sen 1992, 1997).

The problem with distribution is political power. In many rural societies, says Hans Binswanger, land ownership changes and is concentrated in the hands of too few, leaving a large number of peasants powerless and join the flow of migrants. He argues that rapid expulsion of labor in the agriculture sector creates significant distribution problems. While a concentrated land ownership generally is conducive to the production of export crops, the overall development situation in a country choosing this path declines as a large number of peasants are job- and landless. Binswanger finds that rural growth is a better indicator of overall development in a country, the prevailing urban bias to the contrary (Binswanger 1989).

Even where small-scale farmers participate in the export economy, the Western agricultural system rewards the middleman, according to Medea Benjamin and Andrea Freedman. The power of the buyer, distributor and exporter, but also the seller of pesticides and fertilizers, significantly reduces the options the farmer has. While a large-scale distribution system can be useful in a country as developed as the United States, at a lower scale of market development, cooperatives would be more appropriate (Benjamin & Freedman).

— Vietnam is a highly egalitarian country, as evidenced by the equally distributed land use rights peasants enjoy. But development, especially export production, is beginning to change that, as recent increases in landlessness in rural areas indicate. The implications of distribution policies and efforts to curb excessive elite influence over production processes and export opportunities will be decisive in Vietnam's overall rural development.

1.3. Methodology

The following paper is based on a three-month research trip throughout Vietnam in the summer of 1997. I set out to look at foreign investment in the aquaculture industry, which I knew has had disastrous effects on rural communities in other Southeast Asian countries. Although searches on the Internet and in specialized business magazines turned up a lot of interest in venture capital for shrimp and prawn farming, once in the country, I found that in fact the main problem in Vietnam is not an influx of foreign capital to set up factory-size shrimping ventures. The real problem for the farmers, who since the mid-1980s economic liberalization of *doi moi*, Vietnam's *perestroika*, have

received long-term land use rights, is how to feed growing families on a finite plot of land. Foreign companies are present, but more often as buyers of shrimp and prawns rather than as producers. That leads to problems of a different nature, which I explore in the paper.

Thus, while I intended to research commercial aquaculture replacing small-scale farming, I realized that fish and shrimp could also play a role in increasing land yield *within* the setting of the family farm. So my research changed its focus quite naturally, without changing its nature.

I found the Vietnamese extremely open and helpful. Despite the history of communist collectivization, what struck me when I called on ministries or universities — often unannounced, as finding a phone number can be more of a hassle than just going some place — everything happens on an individualistic, face-to-face level. At one ministry, I wanted to leave a message for a vice minister's secretary or scheduler, just to be told to sit down and wait for the vice minister himself.

It is in this context of personal relationships that one must view development in Vietnam. Farmers will not do things because they are so told by a bureaucracy. To persuade them to do things differently, one has to work with them in their fields and gain their trust. It is my belief that the successful projects will be those where a rapport can be created between those who want to help and those who receive the help. While farmers follow the advice from a local Oxfam extension worker, they are reluctant to take orders from the provincial, let alone the national government via a decree.

I found that the best way to meet people was to be passed on from one contact to the other. Not surprisingly, the U.N. office had no problem getting me in touch with a

university department or a ministry, but when I once called a local cooperative and referred to a U.N. agency, my call was not returned. In the field, local universities seem to demand respect. A reference from a agriculture department always yielded results with local farm cooperatives or extension offices.

Respect and culture play an important role when doing business in Vietnam. At one point, a farm manager whose farm I was supposed to visit checked up on me the day before the arranged meeting in my hotel. He was concerned that I would be “one of those foreigners who don’t respect local culture.” He was greatly relieved to see I was wearing long pants and a shirt, and confirmed my visit on his farm.

While being helpful in initiating contacts in the country, the individualistic approach to doing business in Vietnam can also create problems for a Western visitor. I found statistics to be works of art rather than reliable decision-making tools. I would still be hard-pressed to respond to a question on precise yields for rice or fish in a province. In the paper, reference is frequently made to average yields. Rather than indicating an average between different years or seasons, it indicates more often an average between different statistics on one and the same data set.

On the project level, statistics are much more reliable, again suggesting that rural development should be done on an overseeable scale. I have tried to use national or provincial statistics only as benchmarks. For the purpose of my paper, I was particularly interested in individual farms or clusters of farms participating in a given project. Much of my research has thus been conducted through personal visits and interviews with farmers and project managers.

Interviews with farmers were necessarily conducted through open-ended questions. I asked a general question and let the farmer tell me “his story,” what he saw as the most important issue for his farm. This way, I gained valuable insight into the priorities of farmers, and could compare them to the priorities of project managers and government officials.

Questions to trained experts focused on technical issues, numbers, results, plans and targets. Project personnel or academic researchers (generally they are also involved in hands-on projects — glass tower science without hands-on work is not widespread in Vietnam) tended to have a good idea about statistics underlying their projects, given that the national data are so weak or often non-existent. On the other hand, project data are generally collected by the project implementor itself, so that there is only one data set with no possibility for comparison.

During interviews with farmers it occurred that farmers do not always perceive issues the way statistics would indicate. I thus made it a rule to talk to the project managers to get an understanding about projects and problems, then to the farmers, and then again to the project personnel to discuss differences in project plans and perceptions on the recipients’ side.

Case studies linked together the findings from interviews, providing a close look at the real-life implications of policy, research and extension in a real-life setting. The Song Hau State Farm and Oxfam’s Duyen Hai sustainable pond diversification project offered good insights, as they were well advanced and geographically delimited, so that effects of policies and projects could be evaluated within defined boundaries.

Remembering rural development expert Robert Chambers' warning against limiting research to easily accessible areas, the Duyen Hai project also offered the advantage of being remote — which takes on a different meaning during the rainy season (Chambers 1983). The moped ride left me and all my belongings coated with mud from (only) two falls, to the extent that I had problems at U.S. immigration for bringing foreign soil into the country.

I used qualitative analysis, based on statistics, only to explain or probe national policy, such as export opportunities and development goals. I found it troublesome that not even on the provincial level in the Mekong, statistical analysis existed about the job creation history of aquaculture, although the activity is common and has undergone substantial changes in recent years.

Development policy in Vietnam must aim at the poor to improve their ability to make their own, informed choices. Choices on their individual farm, within their cooperative, their village or commune. In most cases, thoughts bigger than that will run against the wall of distrust, in many cases due to a lack of education and understanding, but also on the reasonable distrust in data and the willingness of bureaucrats on various levels to work together.

The U.S. political buzzword of “government devolution” may be incongruous with America's sophisticated interwovenness of various government and business entities across the nation. But in Vietnam, where for most people indeed all business is local, it makes sense to strengthen local authorities and businesses and people, by passing down from centralized authorities broad guidelines along with means to achieve them to the

lower levels. The outcome may not always be exactly what the national policy envisioned, but it likely will be adapted to the local situation and needs.

To borrow from an unlikely source of inspiration in this context, rural development in Vietnam is very similar to a large American investment house's policy for customer satisfaction: "One farm at a time."

CHAPTER 2

ECONOMIC DEVELOPMENT IN RURAL VIETNAM

After years of isolation, Vietnam joined the international community and the global trading system through its form of economic renovation, *doi moi*. This economic opening began only in the mid-1980s. But since then, the country has become a laboratory for development policies. Developing at a breathtaking speed for a decade, Vietnam has all the characteristics of an agricultural subsistence society, and all the ambitions of a new tiger economy. More than four out of every five Vietnamese live in the countryside, and even a substantial proportion of city dwellers make at least part of their living from gardening or urban aquaculture.

This thesis argues that Vietnam must not abandon its agriculture sector in search of rapid industrial development, but instead should intensify its rural economy to integrate it into the export industry. Second, the research in this paper shows that

Western-style agriculture is not the only way to intensify land productivity. The fact that Vietnam exported 3.5 million tons of rice in 1997, half a million more than the United States, bears witness to the opportunities of extensive or semi-intensive polyculture agriculture.

This thesis looks at case studies of agricultural intensification with little off-farm input on small family farms and based on traditional techniques, arguing that such marriages of traditional and improved scientific are the optimal way to develop rural economies from the bottom up, rather than uprooting people in a rapid transformation

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an alien economic system. Specifically, the paper looks at integration of fish and crustacean aquaculture into traditional rice and fishing communities, and suggests policy options.

There are, of course, shortcomings to these marriages of traditional and new, but the overall assessment is optimistic. Vietnamese farmers who integrate their farms with aquaculture are able to work their land often with virtually no soil depletion, in sustainable cycles following the rainy and the dry seasons, with few inputs and with significant commercial success. Academic research and extension are likely to enable them to build on their successes and intensify slowly in accordance with their immediate needs and with appropriate technologies without going deeply into debt or destroying their land in the process. To be sure, dangers exist along this road as well. In some cases, early commercial success invited speculation and overintensification. The consequences are often dire.

One fear is that the sustainable path of slow adaptation is not acceptable for young people. It remains to be seen how long the young generation which grows up with expectations radically different from those of their parents, is willing to follow slow-growth models for the sake of sustainability while forsaking immediate consumption.

Although this paper does not intend to discuss issues of globalization, international trade or North/South relations, it will necessarily touch upon these issues in the process of analyzing Vietnam's success in the agriculture sector. Vietnam represents a helpful case study. A country with a very low concentration of land ownership (or land use rights, as ownership is officially still limited to the government), its agriculture is highly productive. Although a significant percentage of production is for subsistence use, food exports are soaring. Vietnam's policy choices fit the description of a development strategy for commodity-exporting countries by Stewart and Ghani, who say that "*... the general strategy of development should be chosen first — including the desired technology choice, income distribution, mode of production, etc. — a trading strategy chosen which fits in with this, rather than the trading environment dictating the choice of development strategy*" (Stewart & Ghani 1986 1501). The country works within its means to produce an outcome that is desirable. Yet the outcome does not dictate the country's entire policy environment, leaving Vietnam less dependent on international market fluctuations than many other developing countries.

2.1. More farmers, but no more land

While those Vietnamese who have land work hard to make Vietnam the world's second-biggest rice exporter (after Thailand and ahead of the United States, which Vietnam

surpassed in 1997), they are also avid entrepreneurs. Typically, the landless invest what little money they have in a bicycle taxi or in a pump with which they inflate the tires of the millions of bikes or motorcycles that crowd the streets of every town. Street vendors are ubiquitous, and with the relaxation of rules on accommodating tourists, many families have renovated their houses and are now cashing in on the tourism of late. This positive attitude towards work and entrepreneurship bodes well for Vietnam's ability to absorb labor overflows from the rural sector. But overreliance on the economic boom of the last decade is a dangerous gamble. While foreign investment from both Asian countries and the traditional Western investors ran high for the first years of *doi moi*, realism seems to be setting in about Vietnam's near-term prospects as a market for all but low-end consumer goods. The average income of less than \$200 makes Vietnam one of the world's poorest nations, and it is unlikely that the car industry, for example, will sell its products in the country anytime soon. Eleven car makers operate or intend to build plants in Vietnam, including luxury brand Mercedes Benz. Even the predicted doubling of the average income by the year 2000 will keep a Mercedes far out of reach for all but a handful of Vietnamese.

With a young population, the government faces the daunting task of providing opportunities for a large number of eager job seekers. But industrial growth is bound to slow, because of regional problems such as the Asian financial crisis that began in 1997, which is likely to slow investment from Vietnam's top investors, Taiwan and Singapore, but also because of red tape and other obstacles investors face. Even though 1995 was the first year during which manufacturing surpassed farming as a percentage of the economy

(30% to 28%), a year later the industrial growth rate increased more slowly than in the previous year for the first time during *doi moi* (Bloomberg 1996).

The Vietnamese government has so far failed to translate its pro-business rhetoric into legislative action. Joint ventures are still plagued by outdated rules and regulations that give Vietnamese minority partners (most often government-owned companies with access to land, which is under government ownership) a disproportionate share of decision-making power. In addition, legal security is low. Frequently, building permits change during the construction phase of a project, there is no clear law on property rights and foreign businesses complain that red tape obstructs work even where regulations do exist. It appears more and more unlikely that the country will be able to leapfrog directly from an agrarian society to a high-tech industrial nation.

The alternative to rapid industrialization is slow growth, shifting labor gradually from the farm to the city or, preferably, to manufacturing jobs created in the countryside. In the meantime, the land will have to provide for those who have not joined the lucky few who were able to find a job with an international firm or in the service industry catering to foreign businesses or to tourists with hard currency and deep pockets, or the somewhat less fortunate ones who found work in industry. But Vietnam is a country with an amazing rural productivity. Where the country is flat, it is green — the green of rice fields reaching from horizon to horizon, from the ocean to the mountain range that delineates the country like a giant spine. Only the steep, conical hills that jut out from the flat land are untouched. In the mountainous regions, where land is at the highest premium, the hills are often terraced and used for coffee and tea plantations.

Vietnamese farmers are the most land-hungry in the region. Cambodians farm an average of 5.0 hectares, Thais 3.8, Malaysian farmers have 3.5 hectares, Filipinos 2.8 and Indonesians 1.1 hectares (World Bank 1995, 39). Average farm size in Vietnam, by contrast, is 0.6 hectares for families of four to five in the South and the central provinces, where family planning education has had an impact. Among mountain peoples, minority populations with a deep disdain for the central government, family size is significantly larger, while farm size is not. Nevertheless, Vietnam is a significant net exporter of agricultural commodities, ranging from the already mentioned rice to fish and other farm products.

There is little untouched arable land left in this narrow and partly mountainous, partly flood plain country of more than 70 million. Fewer and fewer families can still provide their children with new land for farming. Even under optimistic forecasts of economic growth, Vietnam must rely on imaginative agricultural policies to provide a livelihood to its rural population in the near future, until job diversification and population planning can reduce the pressure on the land. Rural intensification serves as the one available means to increase the yield from the land. Vietnam has embarked on an interesting path of rural intensification, using traditional methods of agricultural integration to intensify sustainably rather than adopting Western high-input monoculture methods. This is partly done by design with the help of university researchers, but ultimately responds to the determination of farmers in defending their traditions and in refusing risky, unknown new techniques, whatever their promise. Not least of all reasons, Vietnamese farmers are poor and cannot afford the inputs needed for intensive Western-

style agriculture. Therefore, cheaper alternatives that are compatible with their traditions need to be found for them.

While exports play an important role in the agricultural sector, and the government wants to strengthen export crops further, integrated farms produce a variety of products, some of which are geared largely, some exclusively towards the local market or subsistence use. Fish farmed in rice paddies are an example. While the rice is sold to cooperatives for domestic and international sale, the fish tend to end up on the village market, mostly because they are too bony and small. Although farmers at present do not mind the limited marketability of their fish, they see the potential of fish farming to provide more income through better production methods.

The result need not necessarily be an increased dependence on exports. As long as Vietnamese farmers produce products both for export and for their own and their communities' needs, the risk of export overdependence is mitigated by a fall-back subsistence production. Export-oriented production alone would have the opposite effect.

In summary, Vietnam faces the problem of overpopulation with respect to the land's capability to feed its inhabitants under traditional methods. On the other hand, traditional methods show too much promise for sustainable development to be discarded for Western-style solutions which are untested in the specific Vietnamese environment and would without any doubt reduce employment among farmers unskilled in off-farm activities. In the following, the agricultural sector's potential role in the overall economy will be explored in more depth.

2.2. Vietnam's agriculture and aquaculture in the overall economy

Adding fish to rice fields is not a new idea to Vietnamese farmers. In this country so well endowed with water, peasants have been fishing rivers and lakes for millennia. With the construction of hydroelectric power plants, reservoirs are now offering additional opportunities for inland fishing. In coastal areas, where rice and other agricultural products do not grow well due to soil salinity and frequent inundations, capture fishing (fishing wild stocks with nets or traps) by local fishers is also common. Both coastal and inland fisheries are under pressure, both from overfishing and competition from other forms of land use (industry, residential development and the associated pollution as well as intensive aquaculture that destroys mangroves, the spawning areas for wild fish — *see below*). Offshore fishing — fishing in areas too far off the shore for traditional small fishing boats — is largely untapped, because Vietnam's domestic fishing industry has not had the technological resources to exploit these fishing grounds, nor has it licensed foreign fishing fleets to exploit its waters on a large scale during the years of international isolation. This paper, however, will not concern itself with offshore capture fishing.

In addition to inland capture fishing, farmers traditionally use their rice paddies for either stocking fish or to catch naturally occurring species. Yields in this form of capture fishing or aquaculture are traditionally extremely low. The fish represent a mere supplement to the main product, the rice. They are freely available without any extra effort or input, and do not represent a drain on the land or water. On the contrary, the eat pests, fertilize the water with their waste and aerate the soil through their constant movement. Thus, they are a perfectly sustainable additional source of income or nutrition for the rice farmer.

The following sections evaluate the benefits of traditional fish farming, potential for intensification within the confines of traditional farming, and problems facing intensification with respect to incompatibilities with other aspects of farming.

2.2.1. On-farm employment in aquaculture

As was described above, traditional fish farming has taken place on farms for centuries. Since this paper is looking primarily at the present and near-future potential of aquaculture integration in providing sustenance and employment for rural people, a look at the labor absorption rates of aquaculture is on order at the outset of this discussion.

The fishing industry is a large employer and has potential for future growth. One million people are active in the capture fisheries sector. Employment in aquaculture is harder to estimate, given that it is mostly practiced by farmers who add fish or crustaceans to their other activities, often without any purchase of inputs or related activities that would then capture them in national statistics as engaging in aquaculture. Employment estimates by the end of 1992 are as follows:

TABLE 1: EMPLOYMENT IN THE FISHERIES SECTOR

Marine Total	800,000	Aquaculture Total	260,000
Capture Fishing	289,000	Aqua-Agriculture	221,000
Other Related	511,000	Aquaculture only	39,000
Total Fishing			1,060,000

Source: Bui Dinh Chung (Marine Production Research Institute: "Socio-Economic Issues in the Management of Coastal Fisheries in Vietnam," in "Socio-Economic Issues in Coastal Fisheries Management: Proceedings of the IPFC [Indo-Pacific Fisheries Commission] Symposium, Conference 23-26 Nov., 1993, Bangkok, by F.A.O. Regional Office for Asia and the Pacific)

As the chart illustrates, estimated employment in aquaculture lags behind capture fishing. One reason is that on-farm aquaculture is mostly practiced extensively. *Extensive* production means that the fish or crustaceans raised stem from natural stocks and are

neither fed nor treated with medicine, i.e.: have to make do with naturally occurring resources. Evidently, the only labor required for such aquaculture is the harvest and, when juvenile fish or crustaceans are stocked in the fields, the catch of the wild fry or larvae.

Intensification would increase the demand for work and potentially allow additional workers to enter the industry. On an improved-extensive level of production, where farmers rely largely on natural inputs but may buy larvae commercially and supplement feed and medicine to naturally available resources on an “if-needed” basis, it is unlikely that off-farm labor would indeed be hired.

Case studies show that *semi-intensive* aquaculture integrated in other farming activities can enhance income significantly, but nevertheless does not alter the farming practices sufficiently to change operations into a commercial venture with professional outside help. But both improved-extensive and semi-intensive aquaculture allow more family members to stay on the farm, as the productivity of small-scale farming increases. Since no investment is made into improved quality and marketability of the side product, the fish, improved-extensive aquaculture generally does not allow a farm to switch to commercial fish sales beyond the local markets. While the line between improved-extensive and semi-intensive aquaculture is blurred, it could be argued that semi-intensive production makes an additional step towards marketability, albeit still with only supplemental inputs to the naturally available ones, but on a regular rather than an “if-needed” basis. Thus, yields remain low but are highly sustainable. In semi-intensive farming, an interest in selling commercially at best possible prices often exists, as opposed to an interest in additional subsistence production with a potential for local sales

at low profits in extensive aquaculture. Both forms of production are characterized by low investments with little risk, low profits, but high sustainability. They also generate no tangible employment from outside the family circle.

The jump from semi-intensive to *intensive* is equally blurred in practice. In theory, intensive farming buys all of its juvenile fish or larvae, uses commercial feed and applies medication on a regular, preventative basis and often according to a schedule rather than a perceived need. Highly intensive aquaculture, almost exclusively monoculture, uses high-tech fish ponds with aeration devices and water pumps, creates large amounts of pollution and is subject to high fish mortality due to the extremely high stocking density.

Intensive aquaculture creates specialized and often well-paying jobs. However, these jobs are few compared to the number of farmers who would produce a similar quantity of fish in less intensive production systems; they often require skills that are not available locally, and they leave behind unemployment after the land has been affected by pathogens and pollution. (*For the environmental impacts of intensive aquaculture see specifically chapter 4.*)

While the proportion of women in marine fishing is insignificant, they do play a role in aquaculture and aquaculture-related activities. Approximately 14% of the jobs provided by the fishing industry in general go to women, mostly in net and other equipment repairs and in processing (Bui Dinh Chung 1993). It is fair to estimate that the proportion of women in these activities would be similar in the aquaculture subsector. In addition, women are engaged in the raising of fish similarly to their general activities in the field. From field experience it is also clear that women are heavily engaged in sales.

With intensification of the industry and increased production for sales on cash markets, above all export markets, the part of the work done by women increases as processing gains in importance. Children in Vietnam tend to go to school, and help out on the farm only thereafter in various tasks.

2.2.2. Small-scale aquaculture potential by region

The fishing industry (capture and fish farming taken together) in Vietnam has already demonstrated impressive gains over the last decade. In 1996, total aquatic production was 1.3 million tons, with aquaculture accounting for roughly 30%, or 400,000 tons (SCP Fisheries Consultants 1996). Growth is projected to be steep, albeit not in all sectors of the industry. Inland capture fishing has peaked and fish resources are under heavy pressure (F.A.O. 1994). The reasons are overfishing and, to a lesser degree, water pollution and alternative usage of waterways and bays for industrial use. Offshore potential and aquaculture, on the other hand, are largely underexploited. F.A.O. identifies as reasons for the low rate of exploitation a lack of technology and outdated techniques as well as post-harvest problems. "*The fishing and processing technologies currently used remain at traditional and rudimentary levels,*" the U.N. agency finds in a report (ibid). F.A.O. also sees shortcomings in marketing. The report points out the lack of information about the end markets, so that most fish are sold to the intermediary bulk market at lower margins than would be possible with better market knowledge (ibid).

In addition to the possibilities associated with better farming techniques, land is still available for aquaculture integration. Vietnam's aquaculture harvest comes from a total area of approximately 545,000 hectares, only roughly one-third of the total area

deemed suitable for fish farming (1.4 million hectares) (F.A.O 1993). An area of 325,000 hectares is used for freshwater species, the rest for brackish water and salt water species. Brackish water aquaculture is dominated by shrimp and crabs, which are almost entirely raised for export. As such, brackish water aquaculture is more likely to be intensive in scope and has been more prone to disease outbreaks and yield fluctuations than the highly sustainable extensive aquaculture practiced in integrated freshwater systems. On the other hand, since brackish water does not lend itself to rice farming, shrimp culture is often the only profitable activity. Nevertheless, integration with other activities is possible. Options will be discussed later in this paper.

With improvements in the mentioned areas of weakness, Vietnam expects to grow its fishing sector significantly. By the year 2000, aquaculture is expected by the Ministry of Fisheries to produce 600,000 tons of products, compared to 1 million tons from marine capture. That represents a growth rate of 50% for the aquaculture sector, compared to 11% for capture fisheries. Marine exports are expected to increase from around \$550 million to \$1.1 billion by 2010, with aquaculture accounting for most of the improvement (SCP Fisheries Consultants 1996). The increasing importance of farmed fish in Vietnam's overall fisheries industry is a new phenomenon. Since the 1980s, fish farming and capture fishing grew in parallel. Aside from the mentioned reduction in inland fish resources, it is likely that the most recent changes in overall farming policy, with the end of collectivization and the emphasis on family farming, have played a positive role for aquaculture development. Farm output has skyrocketed since the economic changes were introduced, and fish are part of the total picture.

Of the 1.4 million hectares suitable for aquaculture, 39.8% (548,050 hectares) are paddy fields, 28.7% (397,500 hectares) are medium or large reservoirs, 21.1% (290,200 hectares) are wetlands and tidal flats, 6.2% (84,700 hectares) are lagoons and bays and 4.1% (58,088 hectares) are small lakes and ponds. Fish are farmed on 325,000 hectares, shrimp on 205,000 hectares. Of the 325,000 hectares used for freshwater aquaculture, 90% are under pond culture, 10% under rice-cum-fish culture.

TABLE 2: FISH PRODUCTION — FARMING VERSUS CAPTURE

Year	Aquaculture Output	Capture Output	Total	Aquaculture as % of total
1981	Metric Tons 180,000	416,000	596,000	30.2
1982	188,000	470,000	658,000	28.6
1983	204,000	519,000	723,000	28.2
1984	223,000	554,000	777,000	28.7
1985	231,000	626,000	857,000	27.0
1986	242,000	597,000	839,000	28.8
1987	249,000	640,000	889,000	28.0
1988	249,000	662,000	911,000	27.3
1989	252,000	661,000	913,000	27.6
1990	306,000	672,000	978,000	31.3
1991	347,000	714,000	1,061,000	32.7
1992	351,000	746,000	1,097,000	32.0

(Source: MoF, Hanoi)

The number of fish cages has decreased since 1975, but recovered since 1990. There were 2,000 cages in 1975, dropping to a low of 700. In September of 1993, F.A.O. counted 5,000 cages with a total production of 4,000 tons of fish. A total of 375 hatcheries produce a total of 6 billion larvae. There are also 200 shrimp hatcheries with a combined output of 300 million shrimp larvae, 95% of which are black tiger prawns (*panaeus monodon*) (F.A.O. 1993).

Cage culture makes use of large bodies of water, such as the ubiquitous waterways and the reservoirs in the mountainous regions where aquaculture is not easily feasible with other methods. It also has high potential for export production, and has

developed similar to shrimping. High capital inputs for start-up requirements and production inputs for export-quality fish have led to intensive operations and the related diseases and yield fluctuation. In addition, farmers are highly dependent on exporters and world markets. At present, the Chau Doc region is preparing for the crash of the industry that after an initial boom has moved to overproduction and is now bracing for a severe contraction. Small-scale, extensive cage culture, by contrast, is possible and practiced particularly in poor mountain villages, where water access is often limited to ponds and reservoirs.

Another form of sustainable fish farming is rice-cum-fish aquaculture. In this system, farmers use the available rice fields to stock fish as an additional product without hurting rice production. Many farmers already stock fish in their rice paddies, and this integrated form of agriculture represents one of the most promising forms of sustainable intensification, as this paper will argue in the following chapters.

Possibilities to engage in these forms of aquaculture in increasing local and regional food supplies vary due to geographical and climatic differences throughout the more than 1,000-mile long country (measured from North to South).

- In the North Mountain Region, there is little opportunity for paddy aquaculture, due to the steep terrain that reduces water availability. At the same time, production in hydropower reservoirs is decreasing, although the U.N. Development Programme (U.N.D.P.) is trying to reverse that trend, seeing in fish farming a way to escape the protein shortage of the local nutrition as well as a way to increase cash crop farming sustainably. Carp has been introduced, but feed supply for this non-indigenous species represents a problem. By contrast, integrated farm-fish systems where fish and other farm

products are raised/grown by using the waste of one product as feed or fertilizer for the others, have shown promise. In this system, called VAC (V — *vuong* = horticulture, A — *ao* = pond with shrimp & other products, C — *chuong* = animal husbandry & poultry), animal manure is used to fertilize a fish pond to increase algal growth. The fish waste then is used for the garden, and a part of the fruits of the garden feed the animals.

- The Red River Delta has an abundance of family-size ponds. The delta has large areas of waterlogged rice fields suitable for aquaculture in the rainy season. Most aquaculture today takes place in VAC systems. The region produces 65% of all shrimp larvae of the country.

- Central Coastal Region aquaculture is less developed, because of the mountainous coastline. Cage culture and sea farming may have good prospects, as the area includes many lagoons and bays suitable for this sort of fish farming. This system produces mollusks (giant clams), yellowtail, scallops and crustaceans (lobster). Between 80% and 90% of Vietnam's lobster and scallops production comes from the Central Coastal Region. Since farming of these cash crops has intensified, pollution-caused pathology has hurt the industry. In the old royal city of Hue, the Perfume River's bay is heavily polluted from intensive cage culture and has attracted international help to cope with the environmental problems. This is indicative of the environmental problems and the associated sustainability issues Vietnam will face in the near future. Particularly where large cities and agriculture meet, competing demands on land and water resources paired with population concentration put heavy demands on the self-regulating powers of the environment.

- In the Central Plateau Region, fish culture prevails in cages in running waters.

Most ponds dry out during the dry season.

- In the Mekong River Delta, 1 million hectares are suitable for aquaculture. One-third of that land is under rice cultivation, some already integrated with fish. Fish culture covers 51,000 hectares, shrimp 126,000 hectares. Nevertheless, fish output is 102,000 tons, shrimp only 39,400 tons, attesting to the extensive nature of shrimp culture in the area as well as the recent problems that caused more intensive shrimp farms to collapse (F.A.O. 1993).

Freshwater aquaculture mainly produces fish for local markets, while brackish water products, like fish and crabs, are often export-oriented cash crops. Both in the Central Coast and the Mekong Delta provinces, brackish water farming is indeed largely geared towards export, with all the financial benefits and production risks that focus brings with it. Those risks will be explored further below.

TABLE 3: FRESH- AND BRACKISH WATER FISH PRODUCTION BY REGION

Area	Production (tons); F=Fresh, B=Brackish	Utilized Area (hectares)	Population (million)
North Mountain	30,000 F	187,400	10.8
Red River Delta	37,000 F	145,700	14.0
Central Coast	11,000 B 14,000 F	221,400	16.1
Central Plateau	3,900 F	65,000	2.7
Mekong River Delta	169,500 B 215,500 F	900,000	22.6

Source: F.A.O. Project Document Vie/92/T02: Fisheries Sector Strategy and Programs, Hanoi, Sept. 23, 1993

Another reason often mentioned for weak exports is Vietnam's dependence on small-scale, traditional farming. This paper argues, however, that the Vietnamese farmers have shown in the case of rice and, in some regions, aquatic products that they are perfectly

capable of producing bumper harvests on small farms and sell them through export cooperatives.

TABLE 4: PRODUCTION FOR DOMESTIC CONSUMPTION/EXPORT IN 1992 (in metric tons)

Product	Domestic	Export
Frozen Shrimp	462	47,797
Frozen Cuttlefish/Squid	324	5,000
Fish Meal	15,155	
Fish Sauce (often made from juvenile fish)	143,352,000 liters	
Dried Products	5,635	4,441
Frozen Fish		15,000

(Source: Ministry of Fisheries, Hanoi)

Given the right incentives and support, the same should be possible for aquaculture all across the nation. Particularly shrimp have become a gold mine for many developing countries, thanks to the voracious appetite of Europeans, Japanese and Americans for these crustaceans.

On the other hand, when the shrimp industry becomes too intensive, it has the potential to destroy entire coastal areas. Many early entrants in the industry who have overintensified have found the return is not worth the environmental loss, and international investors are today looking for individual farmers to buy their harvest from, rather than setting up large-scale shrimp farms themselves, in order to minimize their own risk. The environmental backlash has proven too severe for them in numerous countries. Shrimp farming is today considered by environmentalists one of the top culprits of environmental destruction in international agricultural export production.

2.2.3. Problems with intensification

Most overintensification is associated with shrimping. By international comparison, Vietnam's shrimp industry is an interesting case study. The country devotes a vast amount of land to shrimping, but produces comparatively little output on a large number of small farms. It remains questionable, however, whether the size of the farms is to blame for the low output, or the failed attempts of intensification. As chapter 4 will show, Vietnam has already had its brush with shrimp disaster due to intensive farming, but on a relatively small scale by international standards.

Aquaculture has been blamed for social problems, when small-scale farmers are driven off their land by large, capital-intensive export-oriented farms. Furthermore, environmental destruction can make farming impossible for neighbors of aquaculture ventures. The countries with the highest incidence of social disruption as a consequence of aquaculture development are in Latin America. According to the above numbers, these countries are producing to a large extent in semi-intensive aquaculture, that is, with some external inputs in addition to naturally available feed. Countries with little intensive, high-tech aquaculture, such as India and Malaysia have nevertheless passed laws against the further spreading of fish farms. Their main concern is the destruction of mangrove forests that tends to come with the construction of brackish water fish and shrimp farms. Mangrove land is prime aquaculture terrain because it is located in the flood plains, but healthy mangroves are necessary for the spawning of many fish and crustaceans that form a livelihood for capture fishers.

In Vietnam, intensified aquaculture has led to problems in shrimp culture through the outbreak of diseases and the destruction of crops. No other widespread social problems have been reported, although the pollution issue is taken seriously in areas with

semi-intensive and intensive aquaculture. The government is taking mangrove depletion very seriously, and reforestation efforts are under way.

Finally, decisions on the industry's development are not exclusively made based on export possibilities. There are inherent policy conflicts between different options. Csavas mentions maximization of edible products versus farm income, foreign currency earnings versus import substitution, labor absorption versus labor productivity, resource utilization versus resource conservation, private investment mobility versus help to small farmers and development of vertical integration versus community development (Csavas 1994).

TABLE 5: SHRIMP FARMING IN THE MAJOR PRODUCTION COUNTRIES

Country	# of Farms	Area (ha)	Prod. (tons)	Extensive %	Semi %	Intensive %
Belize	6	600	2,000	0	90	10
Costa Rica	4	800	1,000	0	100	0
Ecuador	1,200	130,000	120,000	60	40	0
Honduras	55	12,000	10,000	5	95	0
Mexico	240	14,000	12,000	25	65	10
Nicaragua	20	4,000	3,000	0	100	0
Peru	40	3,000	5,000	5	90	5
USA	30	700	1,300	0	80	20
Venezuela	7	800	2,000	0	100	0
Australia	33	400	1,700	0	20	80
Bangladesh	13,000	140,000	35,000	90	10	0
China	6,000	120,000	80,000	10	85	5
India	10,000	200,000	70,000	60	35	5
Indonesia	60,000	350,000	90,000	70	15	15
Malaysia	400	4,000	4,000	40	40	20
Philippines	1,000	60,000	4,000	40	40	20
Sri Lanka	900	2,500	2,000	10	20	70
Thailand	16,000	70,000	160,000	5	15	80
Vietnam	2,000	200,000	30,000	80	15	5

Source: Bob Rosenberry: "World Shrimp Farming 1996," quoted in (Erik Hempel & Ulf Winther: Shrimp Farming and the Environment," World Bank, Washington, 1997. Draft. p. 104

In Vietnam, the main issue is Csavas' first point. The fishing industry contributes 9% to gross domestic product (GDP) and 15% of Vietnam's total export value in dollar terms, while the 11 kilograms of fish consumed per capita account for 40% of animal protein in

a country where other meat is still considered luxury (Dillon 1997). From this perspective, the main issue for Vietnam's farmers is one of optimum use of the aquatic production. How can aquaculture enhance farm income through increased production for cash sales without reducing the long-term food supply and other farm production?

2.3. Long-term conflicts between subsistence farming and integrated production

Sustaining production in the face of demographic growth in a situation of limited land availability and conflicts over land use is a key policy challenge in today's Vietnam. The answer for the small-scale farmer is most often extensive aquaculture integrated into a wide range of products with rice on top of the list of priorities, in order to get more out of the existing farm area without depleting the soil unsustainably. According to F.A.O.,

“Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to assure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable” (F.A.O. 1997).

The problem with this definition is the inherent conflict between the needs of present and future generations. In order to sustain a more numerous population in the future without recourse to additional land, intensified use of the available resources is necessary, which in turn can lead to reduced sustainability.

With 80% of the still growing population living in the countryside, the pressure on the land is immense. Yields in extensive aquaculture, on the other hand, are low. The average fish yield of an integrated rice paddy is between 50kg and 400kg per hectare, while shrimp in extensive operations (without rice) yield up to 500kg per hectare. Semi-intensive fish farming with inputs in addition to naturally available nutrients and pond management yields between 500kg and 5,000kg per hectare, while intensive farming can yield 5,000kg to 20,000kg. Under such an intensive regime, however, stocking density is such that diseases are frequent and population crashes occur in regular intervals. Super-intensive fish farming has been tested, with yields of up to 100,000kg/ha, but viral

diseases wiped out the farms after a few production cycles. From the pathology standpoint, everything over 10,000 kg/ha is considered a high risk (Hempel & Winter 1997, 30).

While large and financially well-supported ventures can take a calculated risk and lose a harvest ever so often, for the small farmer in Vietnam this is not an option. Later in this paper, the lack of financial support for small-scale aquaculture will be described. To mitigate farming risks, F.A.O. “*strongly recommends*” the VAC system. Since farmers refuse to abandon rice for reasons of tradition, diversification and additional products on top of rice are key in risk mitigation (F.A.O. 1993). In the VAC system, farmers can optimize for their favorite crop — generally rice — while adding additional cash or subsistence crops — fish, shrimp, vegetables — to the product list. VAC will be discussed in detail below (5.1.1.).

2.4. Conflicting demands on natural resources

In addition to choices farmers must make on their land, they compete with three main competitors for land use. Urban sprawl around the major poles of development is eating away farm land; industrial projects convert farm land into factories; and hydropower development uses rivers and converts downstream areas often in a way unsuitable for agriculture and for fish migration. The first two are linked and occur mostly around major cities. The direct conversion of farm land into other uses is exacerbated by the water pollution that comes with both housing and industrial activities. Pollution and hydropower projects may be the worst threat to agriculture, as their impacts can be felt far from the source of the disturbance. A dam upriver changes the water flows and the

transportation of nutrients while erecting a barrier for fish migration. Often aquaculture in Vietnam depends on the flow of rivers for nutrients and the juvenile fish to be flushed into the paddies naturally, as in extensive systems the farmers could not afford the purchase of feed or larvae from a hatchery.

On the flip side of the coin, economic development is the most promising way of taking pressure off the land, by making future generations of Vietnamese less dependent on farming. Economic development needs electricity, as do the farmers themselves for their development. U.N.D.P. points out that the "*[l]ack of access to energy is a type of isolation that fuels the cycle of poverty. Without lighting, work hours are truncated. Without television and radio, information is slow to reach distant communes. Without alternative cooking fuels, forests are cleared at unsustainable rates*" (U.N.D.P. 1997a).

Vietnam is one of the lowest energy consumers in the region, although a television set, powered from the grid or a generator, is the first indicator of modernity and the spread of consumerism. In remote ethnic minority villages with no road to link it to the world or even markets for their tea and rice, the traditional stilt huts have absolutely no modern technology, with the exception of a TV set and a diesel generator. At four gigajoules per capita per annum, Vietnam's energy consumption is only one-third that of Indonesia, one-sixth that of China, and one-thirtieth that of South Korea. That lag is particularly pronounced in rural areas, where eight out of ten Vietnamese live. U.N.D.P.'s objective is to promote the development of renewable energy sources. For electricity, this includes wind and solar power as well as hydropower. For cooking, biogas is envisioned. Research from other regions exists, so that the emphasis will be on commercialization and popularization (ibid).

Integrated agriculture that allows the simultaneous cultivation of various products is the best way for Vietnam's farmers to increase the yield of their land while largely maintaining traditional farm practices that have proven sustainable for many generations. Vietnamese smallholders have shown that they can produce surpluses for export even without factory-style farming methods that require high capital inputs and pollute the environment with pesticides and fertilizers. On the other hand, Vietnam is trying to square the circle in attempting to develop the economy rapidly while at the same time limiting the impact of industrial activities on farm land and ecosystems that span large parts of the country, such as the Mekong or the Red River deltas.

The history of other developing countries, both apparent success stories and failures, has shown that some degree of environmental degradation and social change inevitably comes with the process of development. Nevertheless, careful development will be concerned with the well-being of the population rather than exclusively with abstract economic indicators. Development based on abandoning agriculture would be wrong-headed in a country whose farm sector has so much to give to the national economy, and would uproot this rural nation beyond the benefits economic development can bring.

Development based on a harmonious mix of agriculture and industrialization must be designed as to allow farmers to feed their families on the land until a natural shift into other activities sets in, fueled by increasing farm productivity that makes parts of the rural labor force superfluous *after* having created alternative economic opportunities. This chapter has outlined the stakes within the context of Vietnam's economy. In the

following, this paper will look at individual problems and opportunities and suggest policy options for the country's leadership and the international development community.

The following chapter will look at traditional aquaculture and opportunities for intensification and commercialization. Chapter 3 explores the issues surrounding commercialization; chapter 4 describes problems that have occurred as a consequence of intensification; chapter 5 looks at various techniques with their pros and cons; chapter 6 investigates up-and downstream linkages within the overall economic environment; and chapter 7 provides policy options and recommendations.

CHAPTER 3

AQUACULTURE: INTENSIFICATION, THE SUSTAINABLE PATH TOWARDS COMMERCIALIZATION

The saying goes that it is rice that feeds the family, and everything else on the farm is secondary. In a country that has a rich history of famine and starvation, such sayings have more power than the wisdom of extension workers. But, as the previous chapter indicated, traditions are changing. Land is no longer available to build new farms on, and farmers understand that they need to adapt to the realities of life to feed their families, even if that means casting aside the sayings of old.

It is difficult, however, to move away from rice in a country like Vietnam, where in addition to the old rice-growing tradition the government is still pursuing a path of food (equals rice) self-sufficiency. Agricultural policies are geared toward rice production; the government exerts a lower tax burden for rice land than for other land uses and buys the entire harvest at a set price, giving the farmer security and yet another incentive to produce rice. All these policies have led to a rice overproduction that places Vietnam second among exporting nations, with 3.5 million tons exported.

Dependence on a monopoly buyer, however, has its risks. Given Vietnam's rapid and continuous transformation to "free-market communism," it is only a matter of time until the government will reduce rice purchases when the markets don't support them any longer. Rice farmers will have to shift to a better mix of products for which there is an actual demand on international as well as domestic markets. Again, intensification in polyculture systems can introduce the farmers to new crops without forcing them to eliminate immediately their fall-back position, rice. Furthermore, polyculture in

integrated systems has tradition in Vietnam and would thus not run up against fears of the unknown or alien production methods.

Research is under way to help optimize a mix of traditional and new crops in an environmentally sustainable manner. As long as this research is based on rice farming and higher yields through new methods of integrating known species, one can speak of improved “traditional” agriculture. Such improvements are preferable to more drastic changes, as they are unlikely to be rejected by farmers. They furthermore allow the farmers to maintain their fall-back positions in case of a crash in their cash crop production or international market prices.

3.1. The market for aquaculture products

If Vietnam’s farmers upgrade their techniques, they can add sustainably farmed fish and shrimp to the list of export commodities. There is a growing world market for these products. Currently, global output of farm-raised fish amounts to almost 14 million tons out of an overall global fish production (incl. capture fishing) of 101 million tons, and aquaculture’s share is rising (Platt 1995, 32). The percentage of quality fish that ends up on tables (as opposed to the trash fish used for protein animal feed) is forecast to reach 40% within the next one-and-half decades (CGIAR 1995).

Vietnam is already among the 10 largest producers of shrimp, the world’s top-selling aquaculture product. Given the fact that Vietnam’s economic development depended heavily on agricultural exports in the past, intensifying the shrimp, prawn and also the fish industries can only be beneficial, as long as intensification is sustainable.

Unfortunately, the most profitable export species seem to be hardest to integrate into a “traditional” farm according to the definition above. Shrimp, prawns and the best-selling farmed fish Vietnam produces are either exclusively monocultured in intensive operations, or, when integrated with rice or other products, do not reach the quality and size for international markets. This chapter will look at the benefits of integrated operations, while chapter 4 will point out problems with overintensification and chapter 5 will discuss intensification methods and their prospects and problems.

3.2. The starting point: Traditional aquaculture

Traditional aquaculture in Vietnam is ecologically sound, sustainable and complements other agricultural production instead of replacing it. Traditionally, agri- and aquaculture are practiced extensively in Vietnam, with no or very little inputs from outside the farm. Hobbelink, a critic of industrialized agriculture, says, “*[m]any rice farmers raise fish in their paddies, harvesting up to 500 kilograms per hectare of additional, protein-rich food at virtually no cost*” (Hobbelink 1991, 142). Inputs, such as animal and human waste and rice husks, are available free on the farm. In extensive systems, juvenile fish or shrimp larvae are trapped in the paddies or ponds and grown out throughout the rice season. After the rice harvest, fish rests, such as dead fish or fish droppings are used to fertilize the paddy for the next rice season (Jandl 1997, 72). The fish and shrimp in the pond also aerate the soil, increasing the per-hectare yield, and act as pest control mechanisms through their consumption of pests and especially insect eggs and larvae often deposited right above water levels. But yields in extensive systems are low and the quality of the product is often bad, because of low-quality feed, the absence of medication and the sub-

optimal grow-out periods due to the varying maturation periods of the different plant and animal species that are nevertheless harvested at the same time.

On the other hand, integration can add to the land's productive periods in the pronounced seasons in the tropical Vietnamese climate. While some areas in Vietnam allow three rice harvests in an around-the-year cycle, others are less productive. Many low-lying areas are prone to flooding in the rainy season, and in coastal areas salinity often restricts the soil's ability to sustain multiple crops per year. In these areas, integration of marine creatures is not used to add an extra product to the regular harvest, but as an alternative form of land use for the off-season. Fish and shrimp can be grown in inundated fields, given that the trenches and dikes can be maintained throughout the storms. These aquatic creatures also clean and fertilize the fields for the next rice season. In this scenario, during each harvest one product is optimized for, while the products change throughout the year.

3.3. Recent political changes: What the government expects from aquaculture integration

One of the key policy changes under *doi moi* was the reintroduction of family farming, replacing the collectives that had been imposed after the communist victory in the war that reunited North and South in 1975. For rice farmers, *doi moi* was a great success, as proven by the rice export data.

But not all farming occurs on the family level, and on a larger scale, *doi moi* was not very successful in attracting foreign investment into rural industries. Between the beginning of *doi moi* in 1986 and July of 1997, 276 international investment projects have been approved in the agricultural sector for a total of \$1.367 billion. Of these

projects, 204 are in the agriculture and silviculture sector (\$1.077 billion), and 72 in the fisheries sector (\$290 million), according to the Ministry of Planning and Investment. Most of these projects are relatively small in scale, averaging around \$5.4 million. The reason is the lack of infrastructure and the land tenure and land use laws and regulations. Not a single project exceeds \$40 million, and only 17% exceed \$10 million. Seventy-four percent are below \$5 million. Taiwan is engaged in 53 projects (\$266 million)¹, followed by the United States with nine projects (\$81 million). The total value of the revenues of the fisheries projects amounts to \$100 million, with 85% of them being hard currency exports. All these agricultural projects have created 20,000 jobs directly, plus tens of thousands of related jobs in industry and services. The average monthly income of the workers employed by these international cooperation projects is around \$60, roughly five times the average national income (Le Courrier du Vietnam 1997a, 3).

While aquaculture is good business in Vietnam, foreign firms frown upon the fickleness of the Vietnamese authorities. Overall, 27% of all the joint venture licenses are revoked before termination of the project. In the fishing sector, the number is 36 licenses, or 50%, for a total amount of \$177 million of business revoked (ibid).

In spite of the small scale of fish farms, the joint ventures with foreign partners have led to a shift from subsistence production to species which are internationally marketable. A study for the Ministry of Fisheries acknowledges that “*[a]quaculture’s shift from subsistence to commercial has changed the face of the industry and has contributed to change in the structure of the economy in coastal areas. From its*

¹ It is interesting to note that Taiwan has ample experience with overintensification. Taiwan bet heavily on intensive shrimping, only to see the entire industry collapse when disease spread across the island like

subsistence base, aquaculture has developed into a commercial activity with exports reaching 50,000 to 55,000 tons and having a value of \$260 million” (SCP Fisheries Consultants 1996). The Fisheries Ministry has a development plan that calls for the increase of aquaculture area by 4.2% to 7.4% annually to reach a potential maximum of 1.25 million hectares by 2010. The export value of aquacultured products is expected to grow by 200% from the 1996 level of \$350 million (ibid).

Pronouncements about the export potential of aquacultured products feature prominently in most speeches of national leaders, and aquaculture has a firm place in the economic transformation of the country. The leadership in Hanoi says it wants aquaculture to do the following:

- (1) Make a significant contribution to coastal area economic development;
- (2) develop sustainably to maximize socio-economic benefits;
- (3) focus on commercial rather than subsistence production for export, while domestic demand must be satisfied;
- (4) contribute to job creation;
- (5) concentrate farm development in the family-size production unit, with state enterprises providing the service support (ibid).

These goals are particularly targeted towards coastal aquaculture, which, due to its shrimp, crab and prawn production has a significantly higher export potential than inland aquaculture. Shrimp account for 50% of export earnings in aquatic products, while inland

wildfire. If Taiwanese investors apply the lessons from their own debacle, Vietnam could be spared some of the worst consequences of overintensification.

products, mostly several carp species and tilapia, are more often consumed on the farm or sold on local markets (A.D.B./F.A.O. 1992).

The government has largely succeeded in three of the five target areas, while falling short in two. On the plus-side:

- Aquaculture has transformed coastal areas, where people had limited possibilities to engage in the traditional agricultural activities, due to saline soils and frequent sea water incursions.
- export production has been stimulated, at the same time as food availability (and actual consumption across the board in all strata of society) has increased.
- family-size farms are at the base of these developments, with state entities acting as cooperatives to provide support that would be out of the reach of the individual farmer (exports, bulk purchases, machinery, extension ...).

On the other hand:

— Sustainability is questionable. While traditional systems have been sustainable for centuries, overintensification has wreaked havoc in many countries, and Vietnam has had first problems with highly intensified systems. Several coastal areas have already experienced crashes in their export-oriented shrimp industries. The experience of the Duyen Hai commune is discussed below (4.4.).

— job creation has not occurred on a large scale in the countryside, leading to an increasing dualism between opportunities in urban and rural areas, land flight and social tensions that come with uprooted people on the move into a new, untraditional life style.

International investors are more often than not interested in goals other than those put forward by the government. Especially sustainability and social equity do not figure high on investors' priority lists. Return on investment must be fast, driven by investors' demands and budget cycles. Such a system is at cross-purposes with the ideal of sustainable aquaculture, determined by cycles of nature. Thus, the government's goal of sustainable development with positive social externalities is not a natural outcome of export-oriented, capital-intensive production. Similarly, the government has placed heavy emphasis on high-value species. At the same time, it wants to increase domestic availability in a market with highly price-sensitive consumers. It is clear from only a few years of *doi moi* that Western investors lured in by the economic reformers have goals different from those needed to fulfill the government's social demands.

The government will eventually have to choose between conflicting policy options, some favoring intensive, some small-scale, extensive or semi-intensive aquaculture. From experiences in other countries in the region, aquaculture expert Imre Csavas catalogued a number of conflicting sets of policy options:

maximization of edible products	vs.	maximum farm income
maximum foreign currency earnings	vs.	import substitution
maximum labor absorption	vs.	maximum labor productivity
maximum resource utilization	vs.	resource conservation
private investment mobilization	vs.	aid to small farmers
development of vertical integration	vs.	community development

(Csavas 1994)

The Vietnamese government seems to have made export earnings from small-farm production a top priority, but has so far failed to pass this decision down to lower echelons of government, notably on the provincial level. On the other hand, the government seems to have all but abandoned the socialist goals of equality and support

for the weak. The government-owned companies that are charged with translating government policies into action, often military- or retirement-fund-run cooperatives on the provincial level, are putting profits ahead of social welfare in a system clearly more market-oriented than socialist.

The overarching problem is that stories of farmers who followed the government's advice, failed and then were left to fend for themselves discourage others from taking risks as long as they can scrape by with what their land gives them under traditional cultivation. Nevertheless, whether by design or necessity, many farmers are intensifying and adding aquatic products to their rice fields. Others, who have done so for a long time, are looking for ways of improving their product quality and quantity. The following sub-chapter takes a look at issues concerning the commercialization of traditionally produced aquaculture products.

3.4. Intensification and commercialization of traditional aquaculture

In most cases, traditional aquaculture sees fish as a mere byproduct to rice. Juvenile fish are added to a rice paddy (or are often naturally present, as rice fields are flooded by natural water flows) and allowed to grow there without further attention until rice harvest time. Then, the fish are harvested when the rice is ripe, with no attention paid to their maturity or possibilities to improve their quality. The move from traditional towards commercial fish farming thus implies an intensification of the operation, such as feeding, purchase of fry and potentially medication, improvement of the paddy to make it more suitable to the needs of the fish and altered growth periods to take into account the maturity of the fish at harvest time.

This intensification in most cases brings with it an increase in production cost. With average farm income below the poverty level and most peasants living from harvest to harvest without financial reserves, they are reluctant to take the risk of adopting unknown production techniques. The costs for aquaculture intensification are highly concentrated around a few inputs. For intensive cage culture, for example, Can Tho University estimates that 40% of the cost stems from the purchase of fingerlings, another 40% from feed, and the remainder from medication, investment and other costs. These costs are imposed by the outside market and are beyond the control of the farmer. Furthermore, if fingerlings or larvae are dependent on wild stocks, low availability can lead to sharply increased purchase prices for the juveniles, which in turn cuts deeply into the profit margins. With very low margins in the aquaculture industry due to high international competition and good possibilities of substituting one species for another, farmers have little leeway in pricing their products. In fact, in most cases in Vietnam the price for export shrimp and fish is determined by the exporter and based on sales possibilities, with little reference to changes in the production costs. It is therefore understandable that poor farmers are reluctant to invest large amounts of money into this risky business.

On the other hand, the rewards can be handsome. Extensive shrimping yields upwards of 300kg per hectare and year, semi-intensive operations pull around 2,400kg per year (in two harvests) out of the ponds. Even if the loss of the rice harvest on the area converted to ponds is taken into account, the net gain is enormous by the standards of a poor Vietnamese farmer. The value of the annual harvest from a 2.5ha semi-intensively operated plot thus reaches \$60,000 at a per-kilogram export price of about 150,000 dong

(roughly \$12) for jumbo-size shrimp. At present, the main problem for the farmer is dependence on middlemen, often the foreign investors or state-run cooperatives, who buy entire harvests and often are in monopoly positions to do so. The farmer, who bears all the production costs and risks, sees only a fraction of the export price for his product. If farmers were able to export directly, their profits might indeed be significant.

In spite of the large cut by the middleman, the comparable income from rice farming is a fraction of the numbers above. At an average rice yield of five tons per hectare and a rice price of 2,200 dong per kilogram,² a farmer who cultivates 2.5 hectares harvests 55 million dong worth of rice (about \$4,500) for two harvests, minus expenses. Of course, input costs for rice farming are low compared to semi-intensive shrimping.³

3.5. Non-traditional methods for producing traditional products

Vietnam's aquaculture sector has not introduced non-traditional products on a large scale. Most creatures raised in integrated farms are known to the farmers, although not all fish species are indigenous. The issue in aquaculture integration is not the product itself, but the methods to improve it.

The use of non-traditional methods obviously faces obstacles, as the case study of Song Hau State Farm in chapter 5.3. will show. Extension workers do best when they apply small changes to traditional systems and build on the improvements once they become visible to the farmer.

² This number represented an average market price for white rice. During the research for this paper, the government set the guaranteed purchase price at 1,600 dong, due to the bumper harvest in 1997.

³ This is a theoretical example based on what is considered a good size farm for semi-intensive aquaculture. The average Vietnamese farmer has much less land available. In addition, many farms must feed four family members or, in the highlands, even more.

It is also helpful to demonstrate improvements in an isolated field or pond. Farmers do not have to fear large-scale problems if the new technique is not suitable for their system, but have an isolated test area to see what use they can get out of the innovation. Development projects can initiate a show-and-tell demonstrator with their own money, and teach farmers the new methods once they have proven successful. For example, in the Duyen Hai project described in this paper, a fish/crab mix can be demonstrated in ponds not linked to others, so that negative effects (pathogens, pollution) cannot spread into production ponds operated by a farmer.

A project in Can Tho that produces biogas from livestock manure started with a poverty alleviation program, through which the participants (1) learned to trust their university partners, and (2) earned the money for the biogas machine themselves. They knew that the first part of the project had worked out before they invested in the second.

Vietnam's economic opening has given farming policy back into the hands of the farmers, after years of collective management of the land. The result was a spectacular increase in productivity, much of which has been achieved by returning to the old practices of integrated, multi-product farming.

Although clinging to their traditional ways of doing things, the pressure from increasing populations that need to be fed on limited agricultural land has made many rural families amenable to accepted a mix of traditional and new. Improved-traditional systems are arising, with support from Vietnamese research institutions and international experts. Innovative approaches can convince distrustful farmers. By and large, the Vietnamese, although mired in traditions and customs, are entrepreneurial and willing to

take an extra step to improve their lot. Results so far are promising. Some of these projects will be discussed in the following chapters.

CHAPTER 4

PROBLEMS WITH INTENSIFICATION AND COMMERCIALIZATION OF AQUACULTURE

While the previous chapters point to the necessity to improve the return from the land and indicate that aquaculture integration is a sustainable means to achieve this goal, evidently there are drawbacks to changing the agricultural methods. One, judging by past disasters in Vietnam and even more so in other countries in the region, is the move towards intensive monoculture aquaculture. The effects are pollution, coastal mangrove destruction, overstocking and the associated disease outbreaks and destruction of the land, to name the most widespread ones.

But even integration of aquaculture into small-scale farming can have negative side-effects, either on the surrounding environment or the economic system. This chapter will describe these problems that aquaculture can cause.

4.1. Environmental limits to continued growth

As is frequently the case when rapid economic expansion collides with natural limits, the environment shows instances of striking back. Early signs of environmental limits include disease outbreaks in areas of high-density farming, water quality reduction, negative feedback loops between coastal aquaculture, agriculture and capture fishing, and soil depletion. On the other hand, it appears that sensitive approaches to intensification can still yield large production increases without over-straining the carrying capacity of the natural resource pool. For example, a World Bank study finds that overall, the

expansion of the prominent crop, rice, has not had significant negative impacts on the environment in Vietnam (World Bank 1995, 62).

4.1.1. Pollution from farm inputs

In Vietnam, pesticide and fertilizer use has not taken on damaging proportions. Only in areas of acid sulfate soils in the Mekong delta, the overall economy will face higher opportunity costs as a consequence of intensified agricultural production, as increased acidification of scarce dry-season water will impact water for fishing and household consumption (ibid).

On the other hand, the Bank observes that the intensification of shrimping in coastal areas is associated with increased use of feed and has had a large environmental impact. Further destruction, particularly of mangrove stands, must be prevented, the document concludes (ibid).

In order to control disease outbreaks early, intensive operations apply antibiotics in ponds and cages at the earliest sign of excessive fish mortality. Where no scientific data exist as to the cause of the problem, medication is applied broadly to address all of the most likely causes. Often, farmers simply lack training about medication. Between 70% and 80% of antibiotics fed to fish or crustaceans end up in the environment, either by being washed out before absorption or through feces. This release results in antibiotics-resistant pathogens which makes future disease prevention and cures more problematic, and changes the bacterial composition of the benthic microbial community (Hempel & Winther 1997, 49).

4.1.2. Disease

The key to sustainability is not rapid, Western-style intensification, but a focus on sustainability. A study of the Than Tri district shows that output per hectare has been absolutely stagnant between 1979 and 1993. Thereafter, under *doi moi*, per hectare yield increased as a consequence of rapid intensification through monocropping for export. (Trinh Thi Thang et al. 1997).

TABLE 6: FERTILIZER USE AND ASSOCIATED INDICATORS

	Cambodia	Thailand	Vietnam	Malaysia	Philippines	Indonesia
Average Paddy Yield tons/ha	1.3	3.1	3.2	3.7	2.7	4.0
% of Area Under Irrigation	10	25	60	73	45	55
Fertilizer Use kg Nutrients/ha	10	39	75	151	63	113
Average Farm Size ha	5.0	3.8	0.6	3.5	2.8	1.1

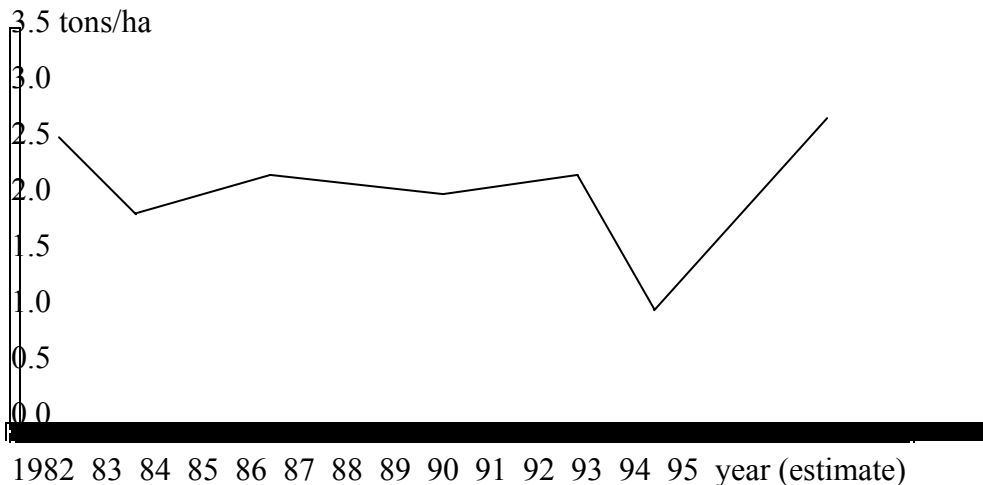
(Source: "Viet Nam: Environmental Program and Policy Priorities for a Socialist Economy in Transition," Report No. 13200-VN, The World Bank, Washington, 1995, p. 39.)

But only two to three years after the first, rapid intensification of the shrimp ponds in the area, shrimp disease hit and destroyed the crop. Farmers began to rebuild their operations with the help of extension workers, with the aim of creating lower-yielding, yet sustainable shrimping operations. The sudden crash scared the local government into increasing research, which is now leading towards yields significantly higher than under the pre-*doi moi* situation, yet far from the high-risk intensive methods. Such research into sustainable aquaculture that at the same time increases yields and quality is the key to an aquaculture industry that meets the needs of the rural population while at the same time providing hard currency earnings for the country's overall economic development. The

successful development in the rice sector, which has been improving output slowly but steadily, should be a guiding light in the endeavor.

The top culprits in spreading pathogens (outside hatcheries, where many epidemics have their origin) are a combination of bad pond management and excessive stocking rates. Most Vietnamese farms are small-scale operations. But even in small operations with low-density stocking rates, effects similar to intensive farming are possible. The World Bank warns about classifying Vietnam's aquaculture as small-scale with respect to the likelihood of disease occurrence. The reason is the close interconnectedness of Vietnam's aquaculture systems. Although each farmer has very little paddy and pond under cultivation, the water flows freely from one farm to the other, carrying with it nutrients, feces and pathogens. Hempel and Winther warned in a draft report that thousand 10-acre farms must be viewed as one large scale operation, if biodiversity suffers and disease can spread between the different farms (Hempel & Winther 1997, 40).

TABLE 7: SHRIMP HARVEST IN THAN TRI PROVINCE



Source: *Than Tri Statistical Yearbook*

The last farmer downstream a long series of fish ponds can accumulate a significant amount of pathogens originating often far from his property.

The solution to the problem of spreading pathogens, better water exchange systems, extremely important in areas with a high concentration of ponds and paddy, are often deficient, and water intake canals draw from waterways used as spillways from other ponds and farms. In extensive systems, the risk is low, as the stocking density is low enough to sustain the fish population without outside inputs. Consequently, the waste products can also be absorbed in a natural cycle without the need for disposal outside the farm, with the exception of the previous argument of downstream accumulation caused by a large number of small farms discharging into the same waterways.

In intensive operations, by contrast, fresh water is pumped in to maintain an optimal salinity of 15-20 parts per thousand. This leads to severe, albeit different, problems. These include increased soil depletion, salt intrusion in the groundwater, and loss of water supplies for other uses (Hempel & Winther 1997, 47). When water management is not adequately addressed, large operations have a more severe impact due to the amounts of feed and chemicals used per acre and discharged into the water.

4.1.3. Soil and ecosystems

Population pressure makes an accumulation of farms, often on marginal soils, unavoidable. The United Nations Development Programme (U.N.D.P.) found that of Vietnam's 77 million people, three-quarters live in the coastal or delta provinces.

Population pressure increasingly pushes people onto fragile soil (saline lands, acid-sulfite

soils, sand dunes, wetlands, mangrove forests and marshes), areas not suited for intensive, long-term human exploitation. Most endangered, according to the U.N. agency, are mangroves, dunes and reefs, whose destruction leads to increased damage from typhoons.

Coastal aquaculture can have severe environmental impacts even in extensive farming. The majority of shrimp farms, the most common coastal system, operate an extensive system with average shrimp production of around 150 kilograms per hectare and harvest. In the Mekong delta, two harvests are usual, in the Tong season from March to July and the Mua season from September through February. Shrimp are usually polycultured with one or more other crops or species, including fish and in the North seaweed. But in poor rice areas, farmers are often more amenable to change to aquaculture alone than in other areas (Le Than Luu 1998).

The Fisheries Ministry finds that, in brackish water areas,

“[t]he high potential profitability of shrimp farming led farmers to change from rice farming, to expand their aquaculture areas or to develop new farms in mangroves, mud flat or underutilized areas. Production increased rapidly over the period to 1994. Most of the production and production increase occurred in the South. The increase in scale, density and intensity of brackish water shrimp farming resulted in a number of environmental problems. As a consequence, severe outbreaks of shrimp disease occurred in 1993/94, particularly in the Mekong delta” (SCP Fisheries Consultants 1996).

In addition to these outbreaks, even healthy shrimp put stress on their environment and create negative feedback loops within their ecosystem. U.N.D.P. says experience has shown that

“devastating consequences can result in the delicate balance of life in estuarine and coastal ecosystems as a result of brackish water aquaculture development. The large financial returns that can result from such developments often come at the expense of

economic externalities that are hidden in the permanent loss of breeding grounds and, hence, species” (U.N.D.P. 1997a).

The breeding ground the United Nations agency refers to is coastal mangrove ecosystems, where shrimp spawn and spend a part of their juvenile life. Farmers cut these mangroves to use the area for ponds and trenches. In extensive culture, the farmers also catch juvenile shrimp when they are washed into the (now cut) mangrove areas, trap them before the tidal waters recede and grow them out. This practice puts enormous pressure on wild stocks. Similar to biomass fishing, where fishers indiscriminately catch all available fish with fine-meshed nets, this method of trapping juvenile shrimp reduces the number of shrimp that ever make it to spawning age, thus reducing the stock at the bottom rather than at the top. The popularity of shrimping has turned vast stretches of prime shrimp mangroves into death traps for juvenile shrimp. Again, even if the individual farms are small, the industry’s impact on the ecosystem can be sizable.

Mangrove destruction does not only hurt future shrimp farming through the destruction of wild stock, it also has immediate effects. The decrease of mangrove areas enhances the effects of pollution and disease. The U.N. Food and Agriculture Organization says *“Mangroves are the best natural filter to improve water quality, which reduces the incidence of waterborne or transported pathogenic diseases” (F.A.O. 1993, 7).*

Thus, mangrove protection, although it tends to slow coastal aquaculture development, is important in assuring the sustainability of the fishing as well as the fish farming industries. Such protection policies are difficult to design, however, as coastal zones are particularly vulnerable to sectoral approaches to development. Emphasis on aquaculture may hurt fishing grounds through the destruction of spawning areas, and could thus hurt offshore fishing.

Another ecosystem-related problem is the competition of introduced species for indigenous ones. As extensive aquaculture is often practiced in rice paddies with natural irrigation, there is virtually no protection against some introduced species escaping into the wild. Introduced species are often herbivorous, as protein feed is not affordable in extensive operations. As a consequence, these species do not prey on indigenous ones.

TABLE 8: SPECIES UNDER PRESSURE FROM AQUACULTURE INTRUSION

Fish Species	Before 1985	Since 1985
Black Carp	rare	rare
Common Carp	very common	rare
Mud Carp	very common	rare
Silver Carp	common	rare
Pike	very common	none
Carasius	very common	normal
Sheat Fish	very common	normal

(Source: Study on Environmental Impacts of Aquaculture, draft Trinh Thi Thang et al., unpublished, draft by the Faculty of Biology, University of Hanoi, 1997).

Nevertheless, intrusion has caused indigenous fish to suffer and has the potential to do more harm in the future, especially as carnivorous export fish and crustaceans are introduced.

4.1.4. Outside environmental impacts on aquaculture development

Fish farms cause pollution that harms the environment around them, but also affects operations themselves. Equally, unrelated industries also place environmental pressures on coastal farming. Upstream logging increases the sediment load in rivers and chokes canals and ports. Jetties in ports can disrupt water movement, sand and species miles away. Integrated development is difficult, because there are inter-agency and ministry rivalries, promoting the projects under their purview, often in competition with other agencies (U.N.D.P. 1997a, 21). The problems of competing agencies are exacerbated in Vietnam by the competition between federal and local governments and the forces of international investors and lending agencies, each with different ideas about coastal development.

4.1.5. Outside environmental impacts from aquaculture intensification

Pollution not only affects downstream fish and shrimp farmers, but can hurt other users of the land as well. One of the most important impacts of shrimping is the sudden increase in demand for protein feed. This demand pushes fish prices on local markets up. While this improves the conditions for fish farmers and fishers, it puts pressure on wild stocks, and at the same time makes it harder for local people to buy fish on the market. Since shrimp are fed fish meal, even the lowest quality of fish can be used on shrimp farms. As a consequence, shrimp compete with the poorest consumers, who normally eat the lowest quality fish not good enough for sale in the cities or for export.

4.2. Pushing environmental limits: Harvest reductions resulting from overintensification

Mangrove loss and harvest reductions are closely related. There is evidence that one-third of the mangroves in the Mekong delta have been converted into shrimp monoculture ponds. F.A.O. says that “[a]s a result, fishery resources harvested in the delta region have sharply decreased,” with Mekong capture fish landings down to 100,000 tons from 160,000 tons “in recent years” [no exact dates provided in the study] (F.A.O. 1993, 6). Total mangrove area at present is estimated at around 125,000 hectares nationwide, down from 400,000 in 1950. In Minh Hai province alone, 40,000 hectares of mangroves have been converted into shrimp ponds since 1983 (Danida undated). Minh Hai is the southernmost province of Vietnam where, due to poor soils that limit rice cultivation, shrimping first experienced a boom, fueled by support from local governments and lack of alternatives for the fisher/farmers. The impact on fisheries and coastal flooding is now so severe that the government has committed itself to substantial replanting (SCP Fisheries Consultants 1996).

The Danish aid agency Danida finds that production losses following disease outbreaks are positively correlated with the number of shrimp hatcheries in a region. These hatcheries release waste, passing all their pathogens on to all other hatcheries and ponds in the area, which draw their water from the same canal or river (Danida undated). Production losses from the 1994 shrimp epidemic in the Mekong alone is estimated to be 5,220 tons. Studies conducted at universities and research institutes in Vietnam suggested that the disease was triggered by a combination of climatic conditions (prolonged drought followed by heavy rains), poor pond design (no separation of water inlet and outlet), low quality seed stock, environmental pollution (residue of pesticides and oils) and poor management practices (inappropriate feeding and mismanagement of bottom sediments) (ibid).

Another cause of losses is the overuse of medication that leads to disease-resistant strains of microbes. Already, fish and crustacean losses are staggering, in spite of the widespread application of medication in intensive culture. In the shrimp industry, throughout the peak year of 1994, 50,000 metric tons of shrimp were produced, with a production value of \$50 million. One-fifth was lost to diseases. Counted by value, the production loss was even higher (50%), as the shrimp most affected were the high-value export species produced in intensive culture.

Trapping of larvae and juvenile shrimp for grow-out in ponds in combination with the destruction of spawning areas has had a significant impact on wild shrimp stocks and consequently on farmers' ability to maintain their operations. The problem of the reduction of wild stocks through increasing seed harvest can only be addressed by setting up hatcheries in shrimp pond areas. A number of small facilities is preferable over few

centralized ones, for the said reasons concerning pollution and disease problems associated with the transportation of diseased shrimp over large areas from one large hatchery.

4.3. Economic issues

Individual farmers can increase their incomes significantly by switching (parts of) their production from subsistence or locally marketed crops to cash crops for sale in cities or abroad. On the other hand, cash crop production has two main dangers: First, if too many farmers switch to a fashionable product at the same time, markets get saturated and prices drop; and second, farmers become dependent on far-away markets on which they have no information and no influence. They need middlemen who often take the lion share of the profits, while they themselves get stuck with the production risks.

4.3.1. Price risk

Vietnam's markets are highly price-elastic. Very little disposable income is available, and most consumers buy only essential goods on a regular basis. If aquaculture were to become too widespread and production were to increase too drastically in a short time, local markets would get saturated with fish rapidly. Under the prevailing conditions of little disposable income, surplus production would force prices downwards, to the detriment of farmers and the benefit of consumers.

As long as farmers produce aquatic products in merely extensive systems at virtually no cost, the net effect may still be positive. The farmer would have more protein

food for family consumption, while at the same time being able to sell surplus, albeit at a very low price.

4.3.2. Dependence on exports

Where aquaculture is intensified, a stable market paying prices that justify capital investments is needed. This dilemma forces many intensified production systems into an export market. Overseas markets are often the only ones that pay enough to guarantee the profit margins for capital investments even if demand is fluctuating. The intensive catfish cage production in Chau Doc shows, however, that a rush to a new product can even saturate international markets and lead to world market prices below what is needed to pay the bills for inputs. Equally, world shrimp prices crashed both when China's aquacultured shrimp reached the market in large quantities in 1989, and again when Thailand joined the fray in 1991. Prices deflated by some 40%, according to the World Bank (Hempel & Winther 1997, 75).

This serves as yet another reminder that it is prudent in a country where alternatives to agricultural occupation are still scarce to intensify slowly and allow for fall-back positions in case the main cash crop turns into a money loser.

4.4. Case study: The Oxfam Duyen Hai sustainable pond project⁴

Duyen Hai illustrates the problems that plague rapid intensification of fish farming, especially shrimping. The poor community hoped to cash in on the global shrimp boom. The outcome was a textbook case of unsustainability due to excessive expectations and too rapid development with inadequate means. Thus, Duyen Hai summarizes the previous

⁴ All data in this chapter from interviews with Oxfam project manager Nguyen Ngoc Diep and a site visit with local Oxfam farming expert Nguyen Than Em, unless otherwise stated.

chapters, and serves as an introduction to the following ones, where the potential for sustainable intensification will be discussed.

As already mentioned, the regions where rice is not growing well due to soil or topographical limitations are prime candidates for the rapid introduction of new forms of agriculture. The poorest commune in the Mekong, Duyen Hai, is such an example. It also has the sad distinction of having gone through a very short shrimp boom-bust cycle within only four years, which left the population worse off than they were before the introduction of intensified shrimping.

Duyen Hai lies at the mouth of the Mekong at the South China Sea. The soil is saline and rice yields are low. The population used to obtain most of its protein needs and income from ocean fishing. But with primitive technologies, fishing was limited to the Mekong itself and nearby off-shore areas. Due to continuing population growth, the fishing grounds could no longer provide sustenance for the younger generation. Influenced by stories about the potential of shrimping, villagers began to cut the mangrove cover and dig ponds. Large-scale shrimping commenced in 1989/90. Although individual farms were small (no larger than four hectares of saline, low-yielding soil), the large number of adjacent farms created the environmental effects of large-scale aquaculture. In particular, the fact that water management was absent and water was drawn from the same sources that also served as outlets for waste water led to a wide dispersion of shrimp pathogens throughout the area. In 1994/5, disease struck the area and shrimping collapsed.

The boom had lasted only four years, largely because sustainability had not been considered at all at the outset. Aside from lacking water management, mangrove

destruction appears to be the main culprit for the crash. Mangroves not only are needed as spawning grounds for fish and shrimp and thus are vital for the continued availability of shrimp larvae, but they also fulfill a vital function in aquatic ecosystem management through their filtering functions, and prevent storms from eroding inland soils. Intensified coastal resource utilization failed, as it often does, as farmers lack the training and the understanding of these ecological connections.

After the crash, the villagers could no longer return to fishing, as fish stocks had been affected by the destruction of the mangrove stands. Not only were fish stocks insufficient to feed the village, they were in a worse state than before the shrimp ponds took hold in Duyen Hai. A life dominated by want changed to life-threatening poverty, with no alternative gainful occupation being available in the area.

The British aid organization Oxfam designed a project to support the commune of Duyen Hai to begin anew and to manage the land sustainably. The project area, a total of 580 hectares, is inhabited by 73 families. In 1997, during the author's visit, 200 hectares were being used for farming and aquaculture. At that time, farmers used their ponds to raise crabs. Shrimp pathogens from the crash could still be present in the ponds and it was deemed preferable to raise a different species. Since the farmers have no financial resources left for inputs, extensive farming prevails. The average harvest is 60kg of crabs per hectare twice a year. The market price for females is 60,000 dong per kilogram, for males 40,000 dong/kg (\$5 and \$3.30 respectively). That leads to an average annual income of 24 million dong (\$2,000), minus the cost for larvae, which must be bought. The price for larvae is 20,000 dong per kilogram.

Oxfam approaches the issue of sustainability from two angles: Land/water management and species diversification. The project wants to mix crabs with shrimp, allowing a rotation of species in the ponds to reduce the risk of pathogen build-up. Also, in case of a disease outbreak, the farmer is not left without any harvest at all, but has a fall-back crop left. As for water and land management, Oxfam recognizes the importance of mangroves for water quality, erosion protection and spawning grounds. Thus, the project limits the land that can be used for ponds to 30% of the total, with 70% remaining permanently under tree cover. At present, farmers are paid for their labor in replanting mangroves.

That space limitation, however, will bring back the original problem of population outgrowing the availability of resources. Where can the next generation of villagers extend their operations to when they need additional income to feed their families? If the families must split their farms among their children, smaller plots must provide higher yields. Given that the present average farm size is a maximum of four hectares, splitting the farms between two children will cut the income of the next generation in half. Here is a simple mathematical example of options for a typical Duyen Hai farmer:

Example 1: Crabs only:

4 ha of crabs, average market price 55,000 dong⁵, 2 harvests, 60kg/ha yield
 $60 \times 4 = 240 \text{kg} \times 2 \text{ harvests} = 500 \text{kg} \times 55,000 \text{dong} = 27.5 \text{mio dong} \sim \$2,300$ (minus 20,000 dong per kg larvae)

Example 2: Half shrimp/half crab:

2ha of crabs 2 harvests \$1,150

2 ha of shrimp $\times 150 \text{kg} = 300 \text{kg} \times 2 = 600 \text{kg} \times 150,000 = 90 \text{mio dong} \sim \$7,500$ (minus cost for larvae)

Example 3: All shrimp:

2 harvests $\times 150 \text{kg} = 300 \times 4 \text{ha} = 1,200 \text{kg} \times 150,000 = 180 \text{mio dong} \sim \$15,000$ (minus cost for larvae)

⁵ The average value is closer to the female market price, as there are more female than male crabs. Research is under way to increase the female-to-male ratio even more in favor of the females.

It is evident that shrimping is the by far most profitable form of saline coastal land use. Once the fear and the memory of failure of all-shrimp culture wear off, it will be difficult to keep the farmers interested in mixed culture or polyculture, as the income differential is extremely high. Farmers are likely to use the new, different ways of production to justify concentrating on shrimp alone. They will base their decision to put their faith in monoculture on the scientific ways of raising shrimp and its ability to prevent the failures of the early 1990s from reoccurring. In a way, the project supports them in this belief by pointing out that the collapse was to be blamed on the environmental deterioration after the destruction of the forest. If this mistake is not repeated, monoculture may be sustainable.

In reality, similar to the discussed rice-cum-fish technique, the solution lies in integrating various crops in a way that does not conflict with the favorite crop — in this case, shrimp. Shrimp and fish can be farmed together. Research about integration of various aquatic species with shrimp is under way at Can Tho University. In an experimental pond, the university staff raise shrimp with tilapia, shrimp with mollusks and shrimp with milk fish. The university also works on complementary feed for fish and shrimp, so that the left-overs and the waste of one could be used by the other species (Nguyen Tanh Phuong 1997).

While farmers should optimize for shrimp to maximize the return from their land, products other than shrimp will end up as a fall-back position in case shrimp crash again, as history shows it will. In this context, there are numerous questions that remain to be researched: Will other species decline when shrimp disease hits the pond, or are these diseases species-specific enough to leave them unaffected? If these other crops were to

be affected as well, polyculture would lose its main attraction, risk diversification. What complementary species could be used for polyculture that does not form an interdependent link with shrimp? Are there fish or other aquatic species that are unaffected by known shrimp diseases? Are there other aquatic species that can be interspersed with the aggressive crabs and thus raise the per-hectare yield of crabbing? Would a deeper pond protect fish from crabs? The Oxfam project is working with Can Tho university to answer these questions.

Several ponds at the Duyen Hai project are unconnected with the others. These could be used as experimental ponds by researchers and extension workers. Success would be witnessed by the farmers and would facilitate introduction of new developments into the regular production systems. Failures could be corrected without widespread impact on the community.

Success and failure of the Duyen Hai project will likely have an even wider impact than that on the commune alone. The province of Tra Vinh, the poorest in the Mekong delta, is heavily dependent on agriculture. Already, more than 17,000 families have no land to work (Le Courier du Vietnam 1997b, 2). With soil degradation and population growth, the next generation will have even more problems to make a living off the land. Sustainable intensification projects are of vital importance in shaping policies for the next decade.

Looking at chapter 3 and comparing it to the previous one, it becomes evident that most problems stem from too large or overly intensive systems, while most solutions lie in intensification at a slow rate. While monoculture shrimping and fish farming is clearly

possible, it is problematic even in countries much more technically advanced than Vietnam. It is thus advisable to increase output of aquaculture slowly rather than jumping into unknown ventures, blinded by potential profits.

Overall, the environmental and social impacts of fish and crustacean farming in Vietnam are not well documented. The intensification in the Mekong, for example, occurred so rapidly that statistics have not yet been developed to evaluate the results of the changes in rural communities (Nguyen Anh Tuan 1997).

The international West-East-South (WES) project is beginning to study the impact of large-scale usage of paddies and rivers for aquaculture on the aquatic systems in the Mekong area. WES is critical about the fact that the rapid expansion of usage of these water resources has not been accompanied by environmental research. Internationally funded, WES could provide important answers to questions raised when intensification fails or where new projects attempt to evaluate their sustainability.

The following chapter discusses different forms of integration, with their promises and dangers.

CHAPTER 5

A PATH TOWARDS SUSTAINABLE GROWTH

So far, this paper has made the case for the necessity of incrementally intensified land use and has laid out problems and opportunities associated with it. In this chapter, it

discusses in more depth the promises of integrated farming and describes the preeminent methods of intensification through aquaculture integration and their pros and cons for the farmer. Although integrated farming has a long tradition in Vietnam, its introduction on a larger scale with emphasis on cash crops represents a change from the production methods and sometimes the product mix farmers understand from generation-long application. Hence, it is necessary to plan intensification and lend a hand to farmers in their quest to increase the yield of their land beyond the possibilities of their traditional techniques.

Foreign investors and international development agencies show a high presence in Vietnam, a country considered to have a chance to experience economic development similar to the East Asian economic miracle nations. They often advise Vietnam's officials to intensify agriculture along the lines of Western-style monocropping. But Vietnam does not have the employment opportunities to absorb the labor that is set free when automated monocropping replaces small-scale, manual farming. In addition, Vietnam's ecosystem is ideally suited for polyculture agriculture, and research has shown that yields can be equivalent or even superior to monoculture when production is properly managed. With a large part of agricultural land naturally inundated, aquaculture emerges as one obvious opportunity for integrated agriculture. A study of 123 farm households by the University of Hanoi comes to the conclusion that the

“most common and efficient model of aquaculture/agriculture integration is VAC (garden-pond-livestock) farming, followed by rice-fish culture, then aquaculture/livestock (primarily pig rearing) and finally aquaculture/horticulture integration. VAC farming appears to be the best model of aquaculture/agriculture integration in terms of on-farm input use, productivity and gross margins. The VAC ... helps farmers obtain higher return and best use of on-farm inputs, lessen their dependency on purchased inputs and sustain farm resource use. In these integrated

farming systems, aquaculture plays an important role in improving farm income, using on-farm inputs and creating employment, reducing risks for the farm household” (Hanoi University of Agriculture 1997).

Farmers and policy planners place a number of expectations in intensification through aquaculture: Policy planners want to add export crops to the prevalent crop, the rice, while maintaining national food self-sufficiency. Farmers want to increase the yield of their land to feed the increasing number of family members on the farm; they want to maintain low-risk farming with a subsistence component (rice, fish for home consumption); and if possible an increased cash flow that brings to the countryside the amenities of the urban centers. To achieve these goals, the agriculture sector needs extension and infrastructure.

Extension is absolutely necessary to allow farmers to increase their output beyond what is possible by traditional methods without falling into the trap over overintensification that leads to environmental collapse. Infrastructure is important to handle the increased output once it occurs, but also to allow the intensification in the first place. In particular, fish and shrimp rearing infrastructure, optimized feed research, production and distribution, and the infrastructure to deal with pollution from the more intensive production are needed.

While infrastructure, such as the mentioned feed research and the provision of hatchery-raised larvae, is costly and must be undertaken on an institutional level, it is a great advantage of aquaculture that most development can be undertaken on the farm level without costly methods of restraining nature. Generally, to add fish to rice fields, dikes must be erected or reinforced, and in some cases the water in- and outflow system adapted. All this work is traditional, and for intensified systems, all that farmers need to

be taught are optimal pond size, water inflow needs for a given stocking density, etc. (ibid). With labor widely available in rural Vietnam, the added work can be handled on a family level without adding constraints to the farm's other operations.

Very marginal improvements to the prevailing extensive systems can have good effects. In improved-extensive shrimping, for example, farmers stock one juvenile shrimp per square meter and add small amounts of feed supplements to the naturally occurring nutrients. Under proper supplementing regimes, output has been known to increase from 200-300 kg/ha to 500-600 kg/ha with hardly any added pollution or capital investment to the farm (Danida undated). In semi-intensive shrimp farming, stocking density reaches 4-6 shrimp per square meter, and feed is added to the pond daily at a level of 3% of body weight. Water needs to be exchanged daily through tidal action or pumping. Fertilizers are applied, and the pond size must be kept rather small. Thus, this system requires capital investment (pond construction, water pumps and other water management systems, fertilizer, seed, feed). Evidently, this form of farming could be a second step once the farmer has (1) gained experience with and confidence in the improved intensive system, and (2) the farm has accrued capital to invest into a better system. Semi-intensive output reaches 1,000-2,500 kg/ha, but on the other hand, the semi-intensive Mekong delta farmers have been hit by disease in 1993/94 (ibid). Thus, this system must be carefully researched and should not be imposed on a very poor area from the outset.

Also, the higher the degree of intensity, the less likely it is that the farm will remain an integrated system. In semi-intensive shrimping, for example, farmers shrimp in designated shrimp ponds rather than in integrated systems where various products are cultivated at the same time.

It is integration, however, that shows the best profitability ratios from a purely economic point of view. Traditional and improved-extensive shrimp monoculture is only marginally profitable based on the costs and returns estimated from surveys in 1995 and 1996 (SCP Fisheries Consultants 1996). The Food and Agriculture Organization says in a study that the VAC system (*see below 5.1.1.*) indeed raises local employment while producing better nutrition for local consumption. According to a project document, it is estimated that nationwide 26-61% of fish production, 43-95% of vegetables, 52-100% of eggs and 23-82% of poultry production is used for family use, the rest is sold for cash (F.A.O. 1993). With its broad variety of products, VAC farms could create an indigenous service sector to the newly industrialized areas. Farmers near factories could provide workers, who depend on food services, with what F.A.O. calls “*street food centers.*” F.A.O. foresees a trickle-down effect of industrialization for farming.

In poor areas without industry, the additional food is as welcome as the employment opportunities from integrated agriculture. U.N.D.P. has acknowledged the potential of small-scale aquaculture both integrated with rice fields or in small ponds. U.N.D.P. provides extension to inhabitants of the mountainous northern regions, who belong to the poorest ethnic groups in Vietnam, with an annual average income of \$100. In the Freshwater Fish Culture Extension Project, one villager sold \$70 worth of fish in the one year following the inception of the program, adding 70% of his original income to his family's available cash. Now, he is helping others to acquire knowledge in fish farming.

The U.N.D.P. project focuses on the most extensive forms of aquaculture possible, to allow these poor farmers with no investment possibilities and no credit to

participate. The project raises herbivorous carp, for which food can be collected in the local forest. Grass for the fish can be cut by the infirm and very young without any experience. The fact that little land is available in the mountains has led the project to introduce cage culture in reservoirs, lakes and rivers. Farmers hatch their own fry in small, hand-dug ponds, and transfer the juvenile fish to cages after two months, where they have more space to grow them out. Since the areas served by this project have no road system or other infrastructure, all agricultural production is used on the farm or traded locally. Since aquaculture replaces slash-and-burn farming, the project has a positive side effect on the environment (U.N.D.P. 1997b).

Again, integration can be used as a start for a move out of poverty. With increased production, infrastructure projects can be attracted to allow further intensification and a shift towards the cash economy.

Different forms of integration are discussed in the following sections, followed by an analysis of problems with integration.

5.1. Methods of integration

In the following, the prevalent methods of aquaculture integration into the farm are discussed. All these methods are traditional, and can be intensified through minor modifications of the farm (paddy, pond) or farming methods (different usage of inputs etc.).

5.1.1. VAC (Field-Pond-Livestock)

Vuon-Ao-Chuong (field-pond-livestock) has developed from the traditional practice of digging up soil to serve as a platform for a house above the soggy soil in the wet delta

regions in the Mekong and the Red River. The hole filled naturally with water and was used as a fish pond. Because of this old practice, between 50 and 80% of all households in the Red River delta have a fishpond attached to the farm house (Chung & Demaine 1995).

VAC's advantage over other forms of integration is that each product is optimized within its own area. Fish are grown in their own pond and allowed to grow according to their own rhythm, while in fish-cum-rice culture, the fish need to be harvested when the rice is mature. The disadvantage is that land must be designated exclusively for ponds, rather than integrating the same patch for multiple species. The farmers must calculate the opportunity cost of each product, which can be high, given the premium on arable land in the heavily populated fertile areas.

The notion of opportunity cost is alien to most Vietnamese farmers. Hanoi University says that *“[F]or a long period, the overriding objective of self-sufficiency in rice production has led [to] the situation that most lands were devoted to rice cultivation without consideration of opportunity cost of other alternatives of land use”* (Hanoi University of Agriculture 1997).

Rice yields in VAC systems are significantly higher in the spring season, and similar to other integrated farming systems in the summer. In terms of gross margins, fish-cum-rice is competitive in the summer, while in the spring season VAC outperforms all other systems. Under VAC, the labor requirements in person-hours is lowest. This can be significant where alternative employment opportunities exist and job diversification is possible. In other areas, it allows more time for alternative occupations on the farm. Not

surprisingly, fish-cum-rice requires the lowest amount of pesticides, due to the integrated pest management qualities of the fish in the rice fields (*see below 5.1.2.*).

TABLE 9: RICE YIELD IN COMPARISON

Spring Crop Season	VAC	Aquaculture/ Livestock	Aquaculture/ Horticulture	Fish-cum-Rice
Yield (kg/ha)	5,343	4,811	4,785	5,074
11,259	12,754	11,693		12,125
Variable Cost (dong 1,000)	4,504	4,025	4,763	4,188
Labor person-days	251	267	263	254
Manure (kg/ha)	5,476	7,077	4,960	5,740
Pesticide (dong 1,000)	121	185	168	108
Summer Crop Season				
Yield (kg/ha)	4,121	4,261	4,092	4,082
Gross Return (dong 1,000)	10,179	9,956	9,802	10,208
Variable Cost (dong 1,000)	3,146	3,650	3,679	2,994
Labor person-days	237	242	259	241
Manure (kg/ha)	4,649	6,322	4,398	5,176
Pesticides (dong 1,000)	107	130	208	93

Source: (Socio-Economic Impacts of Aquaculture, Hanoi University of Agriculture, Hanoi, 1997.)

Fish production is also highly productive in VAC systems. Up to 15 tons of marine products can be harvested per hectare on an optimally integrated VAC farm. The yields are superior to fish-cum-rice, because fish, while often stocked initially in paddies, are grown out in ponds to optimum size. They can also be sold when the prices are best. Third, inputs in the fish pond are optimized for the fish rather than for rice. From the environmental viewpoint, VAC optimizes farm waste by reusing and transforming it before release into the environment. Livestock manure, for example, is channeled through the fish pond and then, in the form of mud, applied to vegetable gardens rather than being discarded directly into waterways, while the latter would be the case in a livestock-only operation.

VAC lends itself well to cash crop aquaculture. While most shrimp species do not do well in rice fields, they can be grown in ponds adjacent to rice fields. Shrimping, however, does not allow for the perfect waste cycling, as shrimp are carnivorous and

need feed other than the algae that the farmer can provide through fertilization of a fish pond with livestock manure. Still, F.A.O. recommends VAC as the more sustainable option over shrimp monoculture. The organization estimates that one-third of all mangrove stands in the Mekong delta have been permanently converted into shrimping operations (F.A.O. 1993). VAC systems allow increased production in coexistence with the forest.

Given the market prices for fish and shrimp compared to rice and other farm products, it is not surprising that in a 1997 Hanoi University study, pond size and farm income show a significant correlation. Furthermore, the number of pigs reared is closely correlated with the income from fish farming. Pig manure is the prime fertilizer for the fish pond. On the other hand, the area under rice and vegetable cultivation was negatively correlated with fish production. Crop cultivation competes with fish ponds for fertilizing manure and space, while giving little back to the pond. The study also hints at the higher requirement for training in aquaculture than in other sectors of farming, as education and the number of hours of extension received had a higher impact on the profitability of the fish farming operations than on the already well-known rice farming (Hanoi University of Agriculture 1997).

These indicators hint at the potential for economic development from VAC agriculture. Farmers slowly move towards a system of higher cash crop ratios, while still always having a fall-back rice crop which, in addition, supports the cash crop through its waste (rice husks for the fish, rice feed for the livestock) and is supported by the other products (manure, pond mud, fish as natural pest control).

5.1.2. Fish-cum-rice polyculture

Fish-cum-rice represents the least difficult integration of rice with other products.

Traditional techniques are widely known and can be adapted to higher-yield production with little technical and financial requirements. As a consequence, fish-cum-rice has the best potential for poverty alleviation for farm families in areas where irrigated rice production is already common. It will be more difficult to turn fish-cum-rice production in an export sector. The fish and rice maturation cycles do not match, and it takes additional investments to overcome the resulting inefficiencies (*see below 5.2.*).

The small fraction of the area actually used for aquaculture in relation to the area suitable for it — 14.5% — indicates that farmers in many areas have not yet realized the potential for integration. Looking at a more localized situation, it becomes clear that the farmers who integrate first are those who face difficulties with rice, particularly in inundation zones or on saline soils. Where the traditional rice grows well, farmers are less likely to try something new.

TABLE 10: RICE AREA USED OR WITH POTENTIAL FOR AQUACULTURE

Region	Potential (ha)	Area in use (ha)	Unused area (ha)
N. Mountains, Midlands	25,109	7,331	17,778
Red River Delta	30,931	4,340	26,591
Central Regions	7,000	-----	7,000
Northeast Coast	32,000	-----	32,000
Mekong Rive Delta	485,000	72,511	412,489
Whole Country	580,040	84,182	495,858

Source: "Aquaculture Industry," Danida Hanoi, Unpublished

Three forms of rice-fish culture exist:

- rice-cum-fish intercropping;
- rice-fish rotation; and
- rice-fed fish culture.

Rice-cum-fish intercropping and rice-fed fish culture are discussed below in this section, while rice-fish rotation is a part of rotation practices, explained in section 5.1.3.

- Intercropping is mostly practiced in the highlands, the provinces of Son La and Thai Nguyen, and more recently in lowland areas of Hai Hung, Ha Tay, Ha Bac and Thai Binh (Hanoi University of Agriculture 1997). Intercropping benefits from the natural symbiosis between fish and rice. Fish eat decaying plant matter as well as insects and their eggs and larvae. They aerate the soil through their constant movement and leave behind natural fertilizer through their droppings. As long as the fish do not receive supplementary feed, the amount of fish manure naturally corresponds to the amount of feed available in the pond and creates a closed nutrient cycle without risk of eutrophication. F.A.O. estimates that extensive rice-cum-fish farming can improve the farm income by 20-25% (F.A.O. 1993).

The most important limiting factor for rice/fish intercropping is the availability of water. In the highlands, for example, farmers who use traditional varieties of rice harvest twice a year, with seasons from February to July and September to December.

Herbivorous species that can flourish in the fields without extraneous inputs (common carp, other local strains) are only intercropped in the second, rainy season, when water is abundant. Rice yields in the mountainous regions are about 2 tons per hectare in spring and 1.5 tons in fall. Extensive fish culture yields 300-500 kg/ha, providing a significant additional on-farm protein supply without extra cost (Hanoi University of Agriculture 1997).

The second limitation is land area. Often times, farmers stock fingerlings in their rice paddies, but transfer them to a grow-out pond once the naturally available feed and

space limits their future growth potential. This technique requires available land as well as some capital investment for the construction and maintenance of ponds and the provision of feed. On the other hand, it can significantly enhance the marketability of the fish. Where a cash market exists, such investments can be recouped rapidly. This form of intensification reduces the land area available for rice, but has no negative repercussion on the rice field in terms of sustainability or environmental degradation. A potential pollution problem arises with the waste from the fish pond. If properly dealt with, no damage to the environment occurs, especially under improved-extensive conditions. For instance, the mud can be used to fertilize the rice paddies if no chemicals inputs are added and the amount of fish is in a natural relation to the rice paddy area, so that the paddy does not get overwhelmed with excessive amounts of nutrients.

Modernization of Vietnam's agriculture has had unintended side effects which further limit the possibilities of intercropping. During collectivization, the government focused in a top-down approach on less water-intensive rice strains. These strains have made a lowering of the water level in the rice fields necessary (Hanoi University of Agriculture 1997). As a consequence, farmers were forced to stock smaller fish species or harvest them earlier. The increased usage of fertilizers and pesticides, advertised by extension workers and often subsidized by the government, which made rice self-sufficiency the highest national priority, had a negative impact on the fish in the paddy. While farmers in many cases saw their rice yield increase and national statistics proudly captured higher sales of rice on domestic and international markets, the "*hidden harvest*" for local consumption was reduced.

Aside from the lower fish catch, short-stemmed rice reduces the biomass harvest the farmers use for various tasks on the farm. Since Vietnam enjoys an abundance of water, both saline and fresh, the introduction of less water-intensive rice strains is unnecessary in most cases and often outright counterproductive from the viewpoint of overall farm productivity.

Research at a national aquaculture institute near Hanoi is looking at the best fish species mix to optimize for environmental paddy management. While bottom feeders are best to reduce mud pollution and to aerate the soil, surface feeders obviously are most efficient in reducing pest infestation. The brown planthopper, for example, a pest that has devastated rice harvests in Indonesia and other southeast Asian countries, lays its eggs close to the water line. Fish reduce the occurrence of brown planthoppers significantly. Paddies where fish were stocked often needed no pesticides at all, while the output of rice increased (Le Than Luu 1997).

Farmers in Vietnam already tend to raise different species of fish in one pond or field to make sure that upper, middle and bottom feeders make full use of the available nutrients. Species cultured include grass carp, silver carp, big head carp, Indian major carps of rohu, mrigal and common carp, mud carp and tilapia (Hanoi University of Agriculture 1997).

While fish yields are relatively low in the highlands and are used mostly on the farm as protein food for the family and local markets, in the lowlands, where water is more abundant, fish can add significantly to overall per-hectare output. Farmers there harvest about 4 tons of rice in the spring season and 3 tons in the fall season per hectare. The fish yield reaches almost 3 tons per hectare. The high fish yield is due to the fact that

the paddies are often times submerged after the rice harvest again, and the fish are allowed to grow to maximum size. At low stocking density, they can be fed with rice bran, fallen rice and insects in the paddy without purchased inputs (Hanoi University of Agriculture 1997).

- Rice-fed fish culture is practiced in the lowlands where rice cultivation faces a very high risk of flooding. About 5% of the farmers in the lowlands practice rice-fed fish farming. Even with only naturally captured fingerlings in flooded ponds and without any purchased inputs, Red River delta farmers harvested up to 1.2 tons of fish per hectare in good years. The system has been developed only recently as a result of land privatization and as a fallback position to rice farming, which is impacted by unpredictable, inclement weather that often destroys entire harvests. To take advantage of fish's comparatively high market price, farmers changed to semi-intensive culture. In this system, they harvest an average of 700 kg more than in extensive culture (Hanoi University of Agriculture 1997). So far, no significant environmental impact or reduction in sustainability have been observed, but the system is relatively new.

5.1.3. Product rotation including rice, fish and other products

Rice-fish farming is the most popular form of rotation farming. It is practiced in the midland, lowland and North-Central regions. This practice is most popular where land suffers from frequent, uncontrolled flooding. In the midlands, farmers stock fingerlings in April, a month before the rice harvest. They cut the top of the rice plant during harvest, and leave the stems in the paddy for the fish. Fish are harvested in October or November. The fish need to be fed, but feed requirements are lower, as the rice stems attract insects

for some species and serve as feed themselves when rotting in the water for others.

Harvests are higher than in a monocrop system. Farmers achieved yields of 4-5 tons of rice/ha and 2 tons of fish/ha (Hanoi University of Agriculture 1997).

Economists contend that particularly in areas with very low rice yield, such as the saline regions along the coastline, fish or shrimp production alone — even in extensive culture — would be significantly more profitable than rice-fish integration. The problems in converting rice fields to other uses are (1) tradition, (2) the risk that many small farmers used to the fallback position of subsistence farming would suddenly depend on a cash crop alone, and (3) problems with supply and demand. If a large number of coastal farmers were to increase fish production, local markets would rapidly be saturated. In an economy with little demand for products other than necessities, price is highly elastic. Even a small amount of oversupply would cause fish prices to collapse. The lack of storage facilities adds to the volatility of fish prices (Le Than Luu 1997). Only significant and capital-intensive intensification and a significant change in products away from the species the farmers know best would allow to produce for export markets with all the risks that entails.

Fry-vegetable culture is practiced mainly in areas where very little land is available, such as city gardens. Three to four vegetable harvests are possible per year, plus one harvest of fish fry. Due to lack of land for grow-out ponds, the juvenile fish are often sold to other fish farmers (Hanoi University of Agriculture 1997).

Salt-shrimp rotation is another traditional system of alternating crops in areas of low fertility. The system is well developed in Vinh Chau, Bac Lieu and Tra Vinh provinces in the Mekong delta. Salt is produced in evaporated ponds during the dry

season from December to May, while shrimp are cultured during the rainy season from June to November. Salt is the principle product. It yields 10 times the income from shrimping, as shrimp production tends to be low (100-150 kg/ha) due to the shallow ponds (20-40 cm) and salty bottoms. One farming method derived from the salt-shrimp system is salt-artemia-shrimp farming. Can Tho university popularized the artemia cyst, which is an excellent food for shrimp. Some salt miners integrate the artemia cyst in their salt-shrimp operations. Research found a farmer can grow 84kg of artemia, 160kg of shrimp, and yield 375 tons of salt on one hectare of land (Danida, undated). If artemia is used in nursing shrimp in semi-intensive farming, higher shrimp yields are common. One foreign aid agency says *“The [early] results indicate a great potential for developing this system, depending on the market of artemia cysts, farmers’ investment ability and extension of artemia culture techniques* (Danida undated).

5.2. Constraints to integrated farming

Constraints to integration, says one of the participants in the previously cited WES study, are the lack of research into appropriate models of integration between different products and species, land use policy, extension, flexible credit, increasing the role of women in the sector, fish disease control research, seed selection and availability, pond management and the improvement of integrated rural development policies. The study also faults government for not fully understanding the important role aquaculture can play in poverty alleviation as well as export production. The result is low credit availability, scattered research left to provincial level governments and the resulting absence of research of a broader than local importance, which is too costly to be

undertaken by private or provincial entities. Examples include seed development and feed for high-value species (Duong Tan Loc 1997).

These problems are institutional and rest on the government level. Given the high priority aquaculture enjoys in recent government policy declarations and plans for the overall economic development of the country, it is likely that the central government will require local authorities more forcefully to follow overall plans on the provincial and local levels.

In the meantime, farmers themselves have experienced constraints to the development of their integration efforts that can be dealt with on the farm. Increased pesticide usage is rapidly developing into a problem for fish farmed in rice fields where chemicals are applied. These substances can be washed away from the rice, but may accumulate in fat tissue and remain in the fish until long after traces can be no longer found in rice.

After realizing the damage pesticide application can do to fish survival rate in the paddy, farmers developed ways to use pesticides in times of high infestation with minimal impact on the fish. They drain the rice field and force the fish to recede into a deeper pond or canal. Then they spray the paddy and increase the water level again after three to four days. Using this method, fish suffer no visible harm, and mortality is no higher than without pesticide application (Hanoi University of Agriculture 1997). Apparently, this method requires deep canals or ponds, which the poor farmers do not have. On the other hand, the poorest farmers do not use pesticides due to lack of capital. Therefore, the pesticide problem is a typical one for intensified farming. Additional sophistication of production brings additional problems. At the end of this is the question

whether the "*improvement*" indeed leaves the farmer better off when all necessary changes are made and the harvest sold.

No fish tissue testing is being done routinely in Vietnam, however. There is only one facility where residue testing can be done, and the cost is high. Such testing is not required by law for domestic sales. Meanwhile, chemical residues could preclude the fish from being exported to a Western market with strict consumer safety requirements. So far, paddy-grown fish are too small to make it onto the international markets. But with improved grow-out methods and the predicted crunch on international fish markets due to global overfishing, Vietnam's vast untapped potential could soon turn into a significant export earner. Studying the impact of pesticide application on the fish will become a necessity. Fortunately for both fish and rice, overall pesticide use has declined with fish in the paddy, due to the fish's integrated pest management qualities as natural enemies of pests.

5.3. Case study: Song Hau State Farm, an example of large-scale integration

Covering a total land area of 7,000 hectares (5,800 under cultivation) in the fertile inland area of the Mekong delta near Can Tho, the province's capital city, Song Hau State Farm is home to 2,500 families and 10,000 people.⁶ Similar to a cooperative, the farmers operate their own land and bear the production risk, while the State Farm itself manages the purchase of inputs, provides extension, buys the farmers' products and manages the processing, marketing and even export. Financially, the State Farm is highly successful,

⁶ All information in this chapter is based on a visit and interviews with farm management officials in August 1997.

with 60,000 tons of rice produced and 200,000 tons exported in 1996. (The difference stems from rice bought from farms outside the State Farm without a direct exporting arm.) The average farmer at Song Hau operates about 2.5 hectares, a good average for the Mekong provinces.

Using its size and export success, Song Hau has tried over the last years to improve its production methods by aggressively pursuing intensification as described in this paper. Hence, Song Hau serves as a good case study of successes, risks and shortfalls of intensification through multicropping.

In addition to the 60,000 tons of rice, the Farm produced 1,000 tons of fish for the domestic market and raised 60,000 chickens. About 500 tons of chicken were exported to Japan in 1996. Three-hundred tons of pork were sold domestically that year, and 50,000 ducklings and 2,000 piglets are raised annually.

Of the 5,800 ha under cultivation, 3,500 are fish-cum-rice. The necessary higher investments for dikes, trenches, water management systems etc. are made cooperatively by the State Farm, and have to be repaid by the farmers after the harvest in the form of loan repayments. Payments are not made as a percentage of income; consequently farmers have an incentive to increase their income, as it accrues to themselves, and to the State Farm only in the form of potentially higher profits from processing and exporting.

At present, the management of Song Hau is pushing for improvements in the fish production sector in the hope to add another export item to their product list. At present, the quality of the fish raised in the paddies is not good enough for export. The fish are too "*bony*," according to the animal husbandry and fisheries department at the farm.

Rice yields are high, and range around 6.5 tons per hectare in the winter/spring harvest and 3.5 tons per hectare in the fall harvest. So far, integration with fish has had no measurable impact on the rice productivity, but it is difficult to measure small swings, as the cooperative buys different rice varieties every year from a nearby rice research center, to reduce the soil depletion from repeated planting of the same strain. Furthermore, the management does not make a concerted effort to maintain statistics for research purposes.

Due to the extensive nature of fish production, the per-acre fish density is very low. Fingerlings represent the only purchased input. Silver barb, common barb and tilapia are set free at a density of one individual per square meter. Tilapia and common barb only have a survival rate of around 10%, while silver barb survive at a rate of 50%. Market prices are highest for common and silver barb (12,000 and 6,500 dong respectively), and low for tilapia (5,000 dong per kilogram). The cost per fingerling is a mere 30 dong. The reason why tilapia are still stocked lies in the species' grow-out time, which coincides with the rice season. Tilapia take four to five months to reach market size, while barb are still immature after the rice season of about four months. The farm has no possibility to stock the fish after the rice fields are drained for the harvest. Thus, the barb go on the market at a suboptimal size and receive much lower prices than theoretically possible. Also, at rice harvest time, local markets are flooded with fish from integrated farms. In an economy with little available money, the prices for food items are highly elastic, responding immediately to fluctuations in the supply-demand ratio. Thus, immediately after the rice harvest, fish prices plummet, and gradually recover to a peak just before the subsequent harvest.

Song Hau's strategy to improve the value of the fish for local markets is two-pronged. First, the farm wants to increase the per-hectare yield of presently 400kg. Second, the value of the fish could be increased significantly if it could be sold out of season, when prices are higher than during the rice harvest time when markets are saturated. Achieving either goal requires that the fish cycle can be separated from the rice cycle. Building grow-out ponds as described in the VAC system in use on small farms has been rejected as too costly for 2,500 farmers. Above all, pond-raising fish in quantities produced at Song Hau State Farm requires significant supplementary feed input. Such feed increases the cost of production beyond the level of profitability. According to Song Hau extension experts, a fish per-kilogram price of almost 50,000 dong would be necessary to justify semi-intensive pond culture. Such prices are hard to achieve on the domestic market, and impossible for the species raised in integrated rice paddy culture. The farm had tried extensive shrimping, but lost money. The paddies are too big to install systems that keep the shrimp from leaving through the water intake canals at low cost. In addition, the rice cycle is even less favorable to shrimping. The shrimp are undersize when the fields are drained for the harvest, and in shrimp more than in fish, size determines market price. The per-kilogram price goes down significantly for smaller shrimp, and exporters demand jumbo shrimp as a matter of principle.

The farms professional staff has devised a plan to increase the depth of the trenches separating the rice paddies from each other. Paddies are divided by two trenches needed also for water management. If trenches were made broader, they could be deeper as well. The management is experimenting with replacing the two separation trenches with one broader one, which could then also be significantly deeper. At harvest time, the

fish could be moved into these bigger trenches until the rice field is readied for the next season's crop. The fish could even continue to be fed on rice and insects, as there would be sufficient rice rests left from the harvest. This strategy would allow the farmers to grow out the fish to optimal market size and decouple the fish harvest from the rice harvest, enabling them to sell at a time when prices are better.

So far, however, only 50 farmers have adopted the system, because the wider trenches cut into the area available for rice farming. There is also a higher labor requirement for a deeper trench, and then there is the ever-present tradition in Vietnam, which requires two trenches, one for each adjacent field. But the State Farm is determined. Within five years, all farmers will grow out their fish in a large trench. Those still reluctant when the deadline approaches will be asked to leave the cooperative, whose land belongs to the government. The management believes the extra work and the small loss in rice area is a good investment for up to 2,000 kilogram of fish per hectare, plus the added benefit from selling fish when prices have already recuperated from their post-harvest lows.

Song Hau State Farm proves that integrated farming on small plots can be profitable with improved traditional methods using local labor. The cooperative charges itself with the integrative factors, such as collective changes of the dike system or the export sales — both functions the farmers could accomplish only with great difficulty or not at all as individuals. Song Hau provides employment and sustenance for entire families in the short run, while the innovations pushed by the management will eventually reduce the labor requirements on the farms. The success of the farm and the fact that the cooperative conducts its export sales itself could eventually allow the farm to

provide surplus labor with processing jobs on the farm, or spur the creation of independent farm-related industries nearby.

Integration of aquaculture is possible without high capital investment. With water in abundant supply, the land is ideally suited for integrated farming of rice and fish or livestock, and for fish multicropping. Methods of integration include polyculture within the same field, resource cycling through managing the waste and nutrient streams between the different operations on the farm, and product rotation.

The main constraints for aquaculture integration are different maturation cycles of products grown or raised in the same field, and, in the same vein, insufficient knowledge about complementary products. Tradition-caused hesitations to adopt new systems also restrain extension workers in their options. While risk adversity has without any doubt prevented farmers from making costly mistakes on many occasions, it also prevents them from adopting proven systems that would allow them to improve the yield of their land.

In order to gain acceptance for new techniques, policy makers must demonstrate that their proposals fit into the overall farming operations, and make a positive contribution to the entire life of the farmers and their community. The next chapter explains how agricultural intensification fits into the overall economic development framework in Vietnam.

CHAPTER 6

ECONOMIC LINKAGES: INTENSIFICATION AND RELATED ECONOMIC DIVERSIFICATION

This paper has so far made the case for controlled, sustainable intensification. The need for higher per-acre yields is an unalterable fact as long as the growing rural populations cannot shift to occupations outside the agriculture sector. Thus, intensification buys time until other measures can be implemented to ease the pressure on the limited amount of land available. It is clear that intensification can only be part of a more global set of development policies. In order to modernize and avoid ever-increasing pressure on the farm land, Vietnam needs to diversify and allow a shift of people into other sectors. In so doing, the government has a wide range of illustrations from other countries in the region at its disposal, many of which offer lessons of what to avoid. This is particularly true for precedents of uncontrolled urbanization and social disruption, inadequate land use policies around poles of industrialization and environmentally unsustainable development, which have been endemic in the developing economies of high-growth Southeast Asia.

Intensification through aquaculture brings with it positive and negative side effects, or, in economic parlance, externalities. The scope of these externalities depends on the level of intensification, from improving traditional, extensive systems to super-intensive industrial systems. Claridge lists a number of problems that can follow in the wake of fish farming:

- decreased production of fish and other food resources where soil quality is impacted by large-scale operations or the destruction of mangrove areas where fish and crustaceans spawn;
- breakdown of coastal communities as a consequence of the previous point and due to the sharply increasing income level disparities between the few qualified to work in an intensive operation and the rest of the further impoverished peasants;
- marginalization of fishers where waste water hurts marine life in local waterways;
- labor displacement;
- credit monopoly for big business;
- reliance on a single economic activity;
- subjection to market forces outside the control of the community;
- concentration of land ownership; and
- indebtedness when an area is abandoned (Claridge 1996, 61).

This chapter will examine these and other problems typical of Vietnam's aquaculture sector and describe government policies designed to address them.

6.1. Aquaculture integration and rural poverty

While farming is a highly profitable occupation in Vietnam, particularly where traditional subsistence crops are integrated with cash crops, it is nevertheless not a panacea for underemployment. Studies in Vietnam found that aquaculture does not have as high a job multiplier effect as initially expected (Bui Dinh Chung 1993). In fact, shrimp farming requires less labor than other forms of agricultural production. Rice farming, for instance, requires up to 10 times as much labor as shrimping per season. Especially extensive

shrimp farming is purely supplementary to rice farming and requires no labor input other than harvesting the shrimp at the end of the farming cycle. In more intensive systems, additional labor is required, but still significantly less than in rice culture (Hempel & Winther 1997, 65).

While aquaculture does not provide the number of jobs policy planners hoped at the outset of the boom, the jobs family-based fish farming does provide benefit the entire village. Women are involved to the same degree in aquaculture as men. Except for the highland zones with their distinct ethnic makeup and varying traditions, between 32% and 40% of the aquaculture work is divided between the sexes according to specific roles, while the remainder of tasks is conducted by both sexes together. That stands in marked difference to horticulture or field crop cultivation, which are predominantly female work processes. In particular, women are dominant in the sale of farm products, with again the exception of the highlands, where most often manual labor is women's work, while men take care of all transactions involving money.

In summary, aquaculture will not be able by itself to absorb surplus labor in rural areas, but does provide some work equitably across all family members on the farm.

6.2. Diversification of employment: Jobs where the job-seekers are

Eight out of 10 Vietnamese live in the countryside. By contrast, a large part of the economic growth takes place around the main urban economic poles of Ho Chi Minh City/Vung Tau, Da Nang/Hoi An and Ha Noi/Hai Phong. Ho Chi Minh City, population 5 million, has experienced economic growth rates of 12% per annum in the 1990s, and accounts for 30% of the nations industrial output (U.N.D.P. 1997a, 15). Naturally, such

economic activity in the cities attracts the underemployed from the rural areas, where growth rates can be lagging significantly behind the national average. The polarization between city and village is even further enhanced by infrastructure improvement projects focused on the cities. Even when they do take place in rural areas (roads, railways), too often their aim is to facilitate the transfer of raw materials and workers into the cities rather than to create equal opportunity in the countryside.

This is counterproductive, especially in an economy like Vietnam's. The oil and agricultural sectors dominate exports. Raw materials for both these sectors are found outside urban areas, and could be processed there by eager workers. There is no economic reason to displace these workers and force them into an uprooted lifestyle away from the social safety net of their villages with their subsistence farming and freely available housing, when the work they are performing in a factory in the city is to process the very products farmed in their own village.

The reasons for this urban development bias are not particular for Vietnam, but are well known from past development experiences. Economic decision makers favor city life. International investors prefer to invest in cities, managers want to live there, banks prefer to loan there, and, not least, governments are located and their power base concentrated there. It is not coincidental that tax-favored export processing zones for *agricultural* products are set up in *cities* rather than in the producing areas.

Even in a country as rural as Vietnam, political elites appreciate urban lifestyles and perceive that cities are the key to holding on to power. To make matters worse, Vietnamese farmers, particularly in the South, have resisted collectivization after unification and as a consequence have lost the trust of the government elite.

Nevertheless, Vietnam's government policies have been much more supportive of farming than those in other developing countries, where agricultural production was used as a cash cow through overtaxation to finance urban development schemes.

In Vietnam, the government is trying to prevent the large-scale conversion of rice land in favor of urban sprawl or industrialization. Rice farming is fiscally favored, one more reason for farmers — on top of tradition and the fear for food security — to maintain the rice crops and add other crops to it rather than replacing rice with cash crops.

But a policy of saving rice farming everywhere is more nostalgic than economically wise. With land prices around the large cities rising, farming on extremely valuable land does not appear to be the best use of the nation's resource base, even if the farms are integrated and produce a higher value of crops than rice alone. Such a policy in fact hinders the needed economic diversification that will allow surplus agricultural labor to move into alternative occupations, by enshrining a sharp split between a rural economy (farming) and an urban one (everything else, including processing of farm goods). It would be preferable to allow the cities to develop valuable land on their outskirts for typically urban activities (high tech, heavy industry etc.), while at the same time giving support to rural areas so they can diversify agricultural industries (natural resource extraction and processing) there.

Hanoi has made a first step in understanding the need for an equitable distribution of increased wealth. The leadership is keen on bringing new industry into smaller cities and towns. France's Total Corporation felt this policy preference when it had a license to build an oil refinery revoked when the company decided the site offered by the

government was too remote to be profitable. Instead of caving to the corporation's demand to build the facility in an urban area, the Vietnamese government pulled the plug on the project and recompleted it (Jandl 1997, 75).

The problem with such policies is that they are based on prohibitions and coercion, and thus distort the market they are supposed to create and direct. It would be preferable to shape policies with incentives, such as investment credits or tax breaks for industry in areas where they make sense. Shrimp processing facilities should be supported in areas where shrimp are farmed, or rice packaging plants in rice farming communities. If the community of Duyen Hai (*see the case study in 4.4.*) were allowed to choose itself what form of infrastructure should be build with a World Bank loan, a shrimp processing facility and a small port with loading facilities would likely win out over a highway to megacity Saigon.

6.3. Downstream opportunities through further diversification

A limiting factor for export-oriented development of the aquaculture industry is processing and marketing. With the emphasis on exports, Vietnam needs to improve its post-harvest infrastructure, which is less crucial when sales occur primarily on the less demanding local markets. The processing industry has expanded greatly over the last one-and-half decades. In 1993, there were 126 freezing and cold storage facilities. Freezing capacity is 600,000 metric tons, cold storage capacity is 20,000 metric tons. Ice-making capacity is 3,000 metric tons per day (Ministry of Fisheries, 1997). The main problem is that the Vietnamese centrally planned infrastructure is not located nearby the production facilities. Hatcheries are often built far away from the farms, and larvae die

during long transports to the farms, while product losses occur on the way from the field or pond to the processing plants (Bui Dinh Chung 1993).

Since the economic opening of the country, the private market has begun to supplement the 350 state hatcheries. Some 500 private facilities produce 1 billion larvae annually, in addition to the 6 billion larvae turned out by state hatcheries. Most of these larvae are for fish; shrimp are still mostly caught from wild stock. Export processing zones, by contrast, are still located mostly in large cities, often far away from the production areas.

An increasingly localized, private industry that supports intensified agri- and aquaculture could provide additional jobs within the areas of expertise of peasants made superfluous on the farm by improved production methods or denied the opportunity to farm by limited availability of farm land.

Vietnam's overall economy would also greatly benefit from better post-harvest management, the reduction in losses from transportation of both inputs and production to far-away processing facilities, and local farmers and their cooperatives would benefit from a higher take of the profits, reducing the influence of the often foreign-based middlemen.

6.4. Social change through income fluctuations from agricultural intensification

Aquaculture integration can play an important role in family income improvement.

Aquaculture is the largest income earner in the lowland, mid-central and midland zones; only in the highlands, field crop cultivation dominated income. This may be due to traditions, the lack of suitable water surfaces, but as well to the fact that in these areas the

cash crops tea and coffee are grown to a larger extent than in the other regions (Hanoi University of Agriculture 1997).

But not all aquaculture integration improves the income situation across the board. Aquaculture helps to improve overall income throughout the community when it is practiced extensively or improved-extensively. Labor requirements in extensive systems suit the traditionally available skills in the community, and all farmers can participate, due to low capital requirements. By contrast, intensive farming has often done the opposite. Frequently, hunters, farmers and fishers all depend on the same land. Where large-scale operations impacted the land through pollution or heightened soil salinity from groundwater pumping, all the villagers who make a living off the land suffer. Jobs, by contrast, are available only to few villagers, as operations are often automated and require technical training. Thus, intensive aquaculture can destroy traditional jobs around its operations, while often few new ones are created.

In addition, large-scale farms for shrimp and other carnivorous fish require large amounts of protein feed in the form of fish meal. Often times, fishers decide to contract with the farm and provide the base for this protein feed. Since size, species, looks and taste of the fish destined to be ground up do not matter, these fishers engage in “biomass fishing.” They use extremely fine-meshed nets to fish even the youngest and smallest fish for the grinders. The impact on local fisheries and those fishers who still try to fish for human consumption is often disastrous. Particularly local consumption takes a hard hit, as shrimp exporters are able and willing to pay a higher price for fish protein than poor local consumers can afford for their own dinner tables. The result is a net transfer of fish

from local consumption to shrimp feed and down the line to First World consumers of luxury food items.

By contrast, where sustainable, small-scale integration is practiced, positive side effects reach through all strata of the community. Even children benefit in their educational needs, a study finds. The Vietnamese focus to an astonishing degree on education. Thus, when family income rises, children are most likely relieved from farm work and sent to school (Hanoi University of Agriculture 1997).

6.5. Dependency on outside forces

Low-level intensification through integration does not change land use structures or community authority. But even in these systems, danger looms in the form of large, outside sales or export organizations. While these can be highly beneficial for a rural community where the individual farms are too small to sell products cost-effectively to far-away markets, they can gain undue influence where they impose products and production methods or abuse their monopoly buyer situation.

Some government-owned export cooperatives have used their legal buying monopoly to force the farmer to assume the entire production risk with no guarantee the cooperative will buy the product. In the area of Chau Doc at the Cambodian border, for example, government-owned AG Fish buys the entire harvest of pangasius, a catfish with good market potential mainly in Japan. The fish are raised in cages underneath houseboats. In the early days of AG Fish's pangasius promotion, the intensively operated cages yielded enough of the expensive fish to pay back the up to \$10,000 initial capital investment in a couple of years. But with more fish farmers joining the boom, the market

soon became saturated and the farmers are now working on profit margins so small that feeding the fish only a few days longer than planned turns profits into losses. AG Fish, all profit-oriented and not at all social-minded, continues to buy only the fish it has export contracts for, and leaves the farmers to fend for themselves⁷ (Campet 1997).

Even more to Claridge's point of big business credit monopoly and reliance on forces outside the community, one government official said banks and AG Fish determine whose farmers' fish need to be bought first, depending on the bank's outstanding loan to a particular operation. Farmers with large operations and high debt can sell their products first, so that bank losses in case of an industry contraction are limited. The farmers who owe less to the banks can sell last, if there is still demand.⁸

6.6. Environmental impacts and land use

Environmental degradation is clearly correlated to the rapidity and scope of intensification. Large-scale monocropping of fish or crustaceans often leads to one or more of three consequences:

- disease outbreaks with mostly devastating results;
- water quality problems due to large amounts of nutrients and medication being released from the farms into the environment. In Vietnam, in most areas waterways form an

⁷ The researcher who provided this information attempted to develop artificial hatching methods for pangasius, which at present is caught in the wild and grown out in cages. The wild stock situation in the upper runs of the Mekong in Cambodia is degrading rapidly because of the aquaculture boom in Vietnam.

⁸ It was impossible to verify this information from a source that understandably wanted to remain unnamed. But whether the situation is indeed occurring or not, the scenario is plausible in a situation where few very large monopoly buyers and lenders interact with many unorganized and fully dependent producers.

interconnected network covering a wide area. Therefore, water pollution has a wide reach around the source;

- in some dryer areas, pumping can cause increased salinity of the soil.

While these problems are known, it has come to light that their consequences differ depending on the method of farming, small-scale or industrial. The World Bank found that large, commercial ventures attempt to recoup as much of their investment as possible by working the land as long and as intensively as possible. Thereafter, they tend to abandon it. Local communities are left without the few jobs the fish farm has provided initially, and without the land that the farm has destroyed. As explained, the surrounding land is often impacted as well through pollution, water level changes or increased salinity levels (Hempel & Winter 1997, 66). Small farmers with integrated operations, by contrast, even if they have intensified excessively and suffered the consequences, very rarely abandon their land. They reduce their activities when first signs of unsustainability occur, or move to other land use options that exploit alternative nutrients or burdens other parts of the ecosystem than those under stress. The land is virtually always kept under cultivation.

While aquaculture has had a significant impact on farm incomes in most parts of the country, it is not a panacea for the problems of demographic growth, which outstrips the land availability for new farms. Eventually, farmers need to move into different sectors as the productivity of the agriculture sector rises. This move must be facilitated by policy planners.

The main problem is the urban bias of many actual development policies, in spite of a general appreciation by the national government that Vietnam is a rural nation with a need to develop the economy in the countryside to avoid massive population shifts and social dislocation.

The following chapter will attempt to tie the previous chapters together and provide policy recommendations based on the issues raised in this paper.

CHAPTER 7

POLICY OPTIONS

The examples of several regional countries have shown that leapfrogging stages of development is risky business. Countries with heavy dependence on the agricultural sector tend to have in place social systems that do not respond favorably to rapid displacement of large numbers of farmers into the cities. City jobs require dramatically different skills, and most rural migrants end up in low-paying positions, mass housing projects, without social ties (with the family far away and work taking up the largest part of the day, so that no new community ties can be formed).

It is significant that Saigon, the largest city (more than 5 million inhabitants) and the main pole of economic development, is also the only Vietnamese city where homelessness, crime and prostitution are rampant. Signs of this social breakdown are ubiquitous. Every street corner is home to individuals or family groups sleeping on mattresses, and alleys turn into public restroom facilities for those without other options. This is not part of a "dirty culture," as some in the West see the Third World. On the contrary, it is in marked difference to the strict rules of social conduct that dominate Vietnamese life. Only under conditions of anonymity — again diametrically opposed to Vietnamese culture, which focuses on family and community — can such a shift occur.

This plea for slow, organic development does not imply that technologies that have proven damaging to other countries cannot be leapfrogged. Of course, Vietnam could adopt less polluting technologies of industrial production and better agricultural techniques to avoid problems that modern economies have already solved. This is a

problem more of financial capability to pay for these technologies than a policy question of whether or not to adopt them.

It is the *form* economic development should take that must be debated before decisions are made that could lead to the described dislocations. While this paper does not argue that the modern economy should be rejected in favor of pure traditionalism, it is in order to point out that the concept of "Western-style development" is often used without a clear definition about what it means. Mainly, the concept means bringing developing countries closer to the production methods and consumption patterns of the so-called First World. That includes monoculture agriculture, abandoning subsistence farming or barter trade, and division of labor in specialized, automated production facilities.

What is forgotten is that to develop this style of economy, the industrialized world needed at least half a century, from the onset of the industrial revolution to the apex of the industrial age. Even this slow, organic transformation has caused tremendous pain, and has given rise to revolutionary movements in its process. In light of this history, it appears foolish to attempt to replicate this "development" within only a few years.

Even worse, there is an aggravating factor. The global economy has undermined the bargaining power of the labor movements that sprang up in the First World throughout the industrialization process. The dislocated farmer in Vietnam today cannot bargain for better working conditions in the factory where he or she now works, when the foreign investor can move capital to another poor nation by simply manipulating buttons on a computer keyboard in a corporate headquarters where information arrives 24 hours per day (as opposed to the information vacuum the rural poor tend to experience).

Thus, the one overriding policy recommendation in this paper can be summarized as follows: Vietnam must not attempt to modernize blindly and destroy in the process the nation's indigenous economy. Modernization, however, is needed. The young want to improve themselves; this desire is inherent in human character, and is not due to Western cultural imperialism. Government policies must assure that economic changes be implemented at a rate that the people can comprehend and participate in, without becoming cheap laborers for an elite that controls access to all means of production, including the newest, most powerful one, information.

The following discussion will present detailed policy recommendations for the agricultural sector. Given the interconnectedness between agriculture and the overall economy, and the importance of the non-agricultural sectors to absorb surplus labor, it is clear that some of the policies needed will not touch upon agriculture alone.

Policy changes are needed on various levels, on the farm, concerning infrastructure between the farm and the market — local, domestic or international, in terms of marketing, market research and post-harvest management — and on a national policy level. Given this paper's focus on small-farm intensification, a large part of the most important policy changes concern the farm level, while international donor agencies often emphasize infrastructure and macroeconomic policies. Nevertheless, since on-farm decisions often depend on rules and regulations as well as on large-scale projects financed by large donor organizations and governments, national policy issues are key to rural development.

7.1. National action plan

Vietnam is not as centralized as an outside observer may think. In fact, after the war, when the communist government tried to collectivize farms in the South, it ran into considerable resistance that led to stand-offs between farmers and police on several occasions. Frequently, the government backed down and farmers continued to farm their own plots. Of course, these farmers often did badly, as they were ineligible to take part in the positive side-effects of government intervention, such as large-scale flood control programs, which in Vietnam's climate are indeed of high importance.

The central government itself is divided and various agencies oversee different aspects of farming, aquaculture, environmental protection, export policy, employment creation, workers right and other related issues. Furthermore, non-farming policy, such as energy generation, play into farming and aquaculture through alternative land use requirements. To be sure, this is not much different in most nations, but donor representatives from even the most bureaucratic countries in the industrialized world deplore the lack of coordination between the agencies with a stake in very similar policy questions.

Thus, the central government should establish a Farm Development Action Plan, which lays out on an interministerial level the desired overall results of rural development, against which the individual agencies and ministries must measure themselves at the end of every plan period. Such a plan would get all the players into one room at the beginning, and force them to pull on one string during execution to achieve a result known and agreed to by all players. The individual ministries would still maintain

the authority to develop policies within their purview, but would have to coordinate with colleagues to assure that their policies are not at cross purposes.

Such action plans de facto exist informally on a very broad and unspecified basis, based on the general policy declarations by the top leadership. These pronouncements could continue to stand at the top of the Action Plan, to give the entire plan the moral and political authority it requires. But at this point, the follow-through is too individualized.

Although master plans exist and are continually established by government and foreign donor agencies, again, ministries often look at them in isolation and pick issues with relevance to their own departments.

A strong performance-based evaluation of ministries and key personnel with respect not to policy development and implementation within the ministry itself, but in support of the overall plan, would help sensitize the highest government officials to the need to execute a common policy. All the following recommendations are related to this point and should fall under a common action plan. They are ranked by priority of implementation.

7.2. Employment creation in the countryside

Surplus labor exists in the rural areas. Jobs are created in the cities. This paradox is common to most developing countries, as it was to the now industrialized world. City living is deemed preferable in most societies once a certain standard of living has been achieved. Yet again, this trend seems unavoidable, but should not be accelerated by government policies that force people from their villages where they have a social

support structure into cities were they turn into anonymous factory workers with all the social ills that such a change entails.

As detailed already, employment should be created where the job-seekers are. With the high proportion of economic output based on agriculture and other forms of resource extraction, there is no need to place processing industries in far-away cities. Such policies are purely reflective of the urban bias of elites, political and economic.

Investors and development experts too often ask abstract questions about the location of an infrastructure project, such as long-term investor confidence, trickle-down effect or the effect on currency value. While important, these questions are consequences of development more than precursors. The key question is, does a given project improve people's lot? Too many large-scale infrastructure projects prepare the playing field for the international corporation or the investor in search of a location for capital placement. The Asian financial crisis of late 1997 has shown that these corporations, while bringing money and jobs in the short run, often fail to have any interest in the long-term development of the place they invest in. To achieve such long-term development, governments must develop the legal infrastructure that provides incentives to these investors to do right by the local people under local conditions.

Large infrastructure projects, such as road construction, are a prime example. The Mekong delta is riddled with them. But most of these roads are built to assure that the rice, shrimp and fish can reach Ho Chi Minh City (Saigon) as fast as possible for cooking, packaging and export. The village of Duyen Hai studied in this paper would be much better off if at least part of the money spent on building a highway were diverted into setting up a shrimp processing plant, a refrigeration plant and a pier, from where the

processed and packaged harvest could be shipped to the exporter somewhere else in Vietnam or even directly to Japan and Korea, rather than seeing these jobs go to the export processing zone in the large city.

A similar problem exists with fish and shrimp hatcheries, which are centralized and depend on fingerling and larvae distribution on roads. Smaller, local hatcheries would be preferable for several reasons, described below.

Unfortunately, large donors feel their organizational structure is not adapted to the administration of microprojects. But there are numerous non-government organizations and community groups willing to administer chunks of a larger budget for the World Bank or other donors which themselves cannot handle loans of less than eight digits. If large donors cannot adapt their operations to help those who need development, and in whose name development is — at least officially — undertaken, they become irrelevant or even a burden to developing countries.

7.3. Infrastructural development

For employment diversification to take place in rural areas, they must first catch up with the lag in infrastructure they tend to experience. However, it is important that the right sort of infrastructure be stressed. Two sorts of infrastructure leave their marks on rural development: The one that supports farming and the one that impedes it in favor of other economic activities, such as hydroelectric development that disturbs water flows, or land conversion for industrial use.

Aside from the already discussed issue of investing in local support infrastructure for local job creation, two problems stand out in the context of intensification through

aquacultural intensification. One is (1) support infrastructure for the industry, in particular hatcheries and feed supply. The other is (2) the alternative water use in hydropower projects, which are under debate.

(1) At present, a small number of large hatcheries produce a large amount of fish fry and shrimp and prawn larvae. Prices are inflated by the need for compensation for high mortality rates during transportation, and the economic effect of disease occurrence, which affects a large percentage of total output even if it hits one single hatchery. A number of smaller hatcheries closer to the production areas would alleviate both problems, while creating local employment in an industry the population knows. In addition, smaller hatcheries producing for a local market could adapt to market changes and environmental requirements faster than a large, national hatchery can. In the context of the Duyen Hai case study, a local hatchery could have switched from shrimp to crab larvae immediately after the shrimp disease outbreak.

(2) The second big issue is water use. Vietnam has a competitive advantage over many other producers of both rice and aquatic animals through the ample availability of water. A multilateral venture between Vietnam, Laos, Thailand and Cambodia, the Mekong Advisory Committee, plans to build 58 dams along the course of the Mekong, one of the two large river systems in Vietnam. Scheduled to be complete by 2020, this dam system would generate 37,000 megawatts of electricity for the growing economies and rising living standards.

The potential is enormous. Laos alone hopes to generate 18,000 megawatts. Today, it generates a mere 210 megawatts, yet the export of electricity represents the top foreign currency earner in this poor country (Barnes 1994, 38).

The economic melt-down of the later part of 1997 has slowed the appetite for energy in the energy-importing countries in the region (Thailand, Malaysia). Nevertheless, internal as well as global electricity needs are continuing to increase. This presents a vicious-cycle problem. If the dams destroy too much farm and aquaculture land, the economies of the heavily rice and shrimp-dependent countries of Laos, Cambodia and Vietnam will slow down, making the electricity output unnecessary. On the other hand, as long as the economies are growing, they need more energy to fuel their growth.

The way out of the dilemma is not simple. It implies solutions that even the industrialized nations have not yet been willing to espouse, although they may be easier to implement in Vietnam than in, say, Germany, given the dramatically lower energy needs in the former.

Vietnam could be a hotbed of alternative energy production. Projects exist to turn manure into biogas. If implemented on a larger scale, this method of energy generation could fuel the needs of entire farming villages. At present, a pilot project in Can Tho (Mekong delta) produces so much biogas on participating farms that the farmers regularly have to vent gas into the atmosphere when their tanks are full. Biomass, tidal and wind plants are additional alternative energy sources that, given the relatively low needs in Vietnam compared to the standards of the industrialized world could close the gap between generation and new needs for a time, while technologies mature.

7.4. Rural credit

Both for infrastructural development and farm improvements, credit is of the utmost importance. so far, unfortunately, the lack of coordination between the top policy makers and the local implementation is seen very dramatically in the rural credit sector. Given the importance of the agricultural sector for Vietnam's overall economy, it is natural that the provinces have rural development banks. But these banks are not in synch with the general policy pronouncements about the importance of intensification and aquaculture. Often, particularly after crashes in the wake of overintensification, credit for aquaculture integration or pond improvement is all but unavailable, while funds for rice and poultry farming, considered less risky but also less profitable, abound. When farmers cannot get access to credit for improvements they are taught by extension workers, the mixed signals they receive make acceptance and spreading of aquaculture much less likely.

It is difficult to mandate to banks to loan to sectors they feel uncomfortable with or feel are too risky. But again, if government policy was passed down to these state-owned banks, the performance reviews of managers should not only include a loan repayment ratio, but also how well overall policy goals have been met with the money the bank lent. Bank managers would then be put in charge not only to lend money blindly to a sector they are ordered to support on one hand, or to a sector they consider the lowest risk on the other, but also to assure that proper farming techniques be observed in utilizing loan money. Applications could be made contingent on prior participation in an extension course, or adherence to a sales cooperative. Development bank managers, who are in fact part of the rural development team and not managers of profit-making banks,

would gain a more integral role in the development of the rural economy, bringing to the table their expertise, which lies in risk assessment and management.⁹

7.5. Risk mitigation

The free market brings with it risks and opportunities. But in a country where one bad harvest can spell doom for a farmer and his family, risk mitigation schemes, which are common in the industrialized world, are absolutely necessary. Farmers will adopt best known practices more readily if they have some assurance that they will at least be reimbursed some of the damage in case the extension worker was wrong.

Crop insurance, for which the farmer could be asked to pay in the form of a certain percentage of sale value, could be made contingent on the adoption of best practices and policies proposed by extension workers. The insurance can also be coupled with rural development bank loans, as described in 7.4.

7.6. Local market support

The main weakness of Vietnam's farmers is the dependence on outside forces in order to benefit from changes in production financially. Intensification often requires inputs from hatcheries, chemical companies and feed mills, and products cannot be sold on markets outside the immediate vicinity of the village. Market information is unavailable, and buyers tend to hold the monopoly over prices for both the inputs the farmers must buy and the products they want to sell.

⁹ Of course, after so many years in a centrally planned economy where risk and profit were no variables to be accounted for, bank managers may not be experts in this field. It will be the job for another sectoral

The example of the Song Hau State Farm indicates that local cooperatives cannot only produce large amounts of crop, but also manage intensification and export it directly abroad. Certainly, similar cooperatives could produce surplus farming production for sale in the newly industrialized zones where salaried laborers depend increasingly on purchased food for lunches.

However, a government-operated state farm is not necessarily a benign organization with only the best for its members in mind, but often has its own agenda that makes it act like an outside middleman. Competition between several such cooperatives could increase farmers' choices and prevent dependence on any one dominant player.

Government policy should favor the development of localized businesses independent of foreign or city-based middlemen for the production and processing of cash crops in the towns where they are produced. For this to occur, several business sectors must be improved. First, farmers need extension so they understand the market value and opportunities on top of the mere technical knowledge to produce a certain crop well.

But equally, they need to understand what the crop's value is, where and how it can best be sold and when production changes are needed. Both the necessary extension work and the provision of freely available information are classic government functions.

As was already mentioned, the rural banking sector needs to be adapted to support a modern agricultural economy. The same goes for technical extension and research. Primarily, farmers require knowledge about the optimal product mixes between rice and cash crops in demand on international markets. Today, too many farmers simply produce

development project to change this problem, where it exists.

what they hope they can sell based on ad hoc promises from buyers with no long-term interest in a region.

Lastly, there is a need for better post-harvest infrastructure in the production areas, to prevent spoilage from inadequate storage or long transportation to the processing centers. International donors prefer better roads to link the infrastructure with the production areas, while for the sake of better job diversification in the countryside it would be better to focus on infrastructure in the areas where underemployment exists at a large scale. Local packaging and freezing facilities could create local jobs while at the same time reducing post-harvest losses and improving overall farm efficiency as a result.

7.7. Land use and zoning

It is difficult to prioritize the last two items, zoning and environmental legislation. They have to be drafted as the previously mentioned policies are implemented. For example, as infrastructure is created, rules and regulations must be applied along the way. These last two points should therefore not be seen as low on the priority list, but accompanying the other policies according to their progress.

After the model of collectivization failed and *doi moi* took hold in the 1980s, individual families were again granted land use rights, often for very long periods. But all land still belongs to the state, and outright land ownership remains illegal. Thus, farmers are reluctant to invest money or even excessive amounts of labor into upgrading the land when the results would be felt only after a long maturation period. On the other hand, for a Vietnamese farmer, the notion of "long term" is quite different than for an American extension worker, for example. Life revolves around harvesting seasons, of which there

are two or three in Vietnam, depending on the area. If farmers have to take out loans, they often want to see results in the following season, as interest payments under volatile farm product price conditions are a high risk. Thus, with 30-year land use rights, a farmer could consider a large investment only worth the risk if it were to pay off within a season or maybe a couple of years.

A major problem for the small farmer is the encroachment of urban sprawl, from housing, but even more importantly from industrial development, on the land. The Vietnamese government recognizes the importance of agriculture, but has reacted in too heavy-handed fashion to the threat to farming from alternative land uses.

The government has outlawed the conversion of rice land for other uses as a rule, although permits are given. This strict policy of protecting rice farms may look positive on the outset, but has some troublesome aspects. First, many farmers keep rice on their farms because of the legal protection that this traditional crop brings with it. (Rice farming is also tax-sheltered, another incentive to continue this occupation.) But rice is an abundant and therefore cheap crop, while other agricultural land uses, including fish farming, are more profitable. This paper has argued that integration is the optimal land use overall. But exactly where rice farming is most protected — at the edge of the city where encroachment can be prevented legally as long as rice is farmed — it makes least sense. Rice constitutes in fact the lowest-yielding use of the land overall. As a consequence, rice land value contrasts most sharply with industrial or other high-yield use, and thus causes the strongest pressure to abandon farming.

The U.N. Food and Agriculture Organization points out that the changes in life style in cities, where employed labor depends increasingly on food services rather than

home-prepared meals, could give rise to a new service industry such as street food stands, potentially selling prepared food from the family farm on the outskirts of the city. In this situation, farmers and consumers would be best served if the farms surrounding the city grew and raised a wide variety of products. The tax code should therefore be amended to protect and give tax advantages to farms with a product mix and integrated farms, without regard to rice being grown.

Such a change would increase the farm's product value and make it more competitive with alternative land uses, although if Vietnam wants to develop an industrial economy, large-scale conversion around poles of development will be inevitable. Again, gradual change is desirable. With growing affluence in the cities, farmers will find better markets for their products, will be able to increase their farms' outputs and at some point be able to afford a truck to bring their products into the city from farther away, where land values are still low enough for farming to be profitable.

In summary, Vietnam's government should take a close look at its zoning legislation, determine the best land use, allow high-value industries to push into agricultural land slowly, while giving tax incentives to farmers on the edge of the industrialized zones to grow food for local demand as well as to fulfill the demand of export processing zones.

7.8. Environmental legislation

Farming in general and aquaculture in particular are polluters, but they are also particularly sensitive to pollution from the outside. Thus, while some environmental

regulations would potentially harm farmers through their impact on production, tough environmental standards would in general be beneficial to the rural sector.

Vietnam's small scale farmers are used to producing their crops, including fish and livestock, in closed input-output cycles with little waste leaving the farm in the form of pollution. It is thus important that extension workers who teach farmers new, more productive and profitable methods of farming, include pollution prevention in their curriculum. Most farm pollution stems from non-traditional systems. Intensified cage culture serves as an example in which farmers overfeed and overmedicate fish out of ignorance, wasting inputs in the process in addition to polluting their working asset, the Mekong river.

Pollution laws should be passed and enforced for industrial pollution, which is bound to increase along with the numbers of factories and export processing zones in the country. Such laws, if properly enforced, would assure that Vietnam does not become yet another dumping ground for First World industries unable to meet legal standards at home. They would also prevent industrial growth from destroying the rural sector through the destruction of the land and water.

As a late entrant into the global marketplace, Vietnam can position itself with regard to the latest economic conditions with more ease than nations that have already invested heavily in infrastructure that may be out of date. Vietnam has weathered the Asian financial crisis of 1997/98 relatively well compared to other regional countries, especially some of those known as the Asian miracle economies. But this crisis has demonstrated to Hanoi's economic planners that markets are fickle, and that overdependence on

international investment flows should not be counted on exclusively to grow the country out of the dilemma of growing populations with little gainful occupation. The main investors, Taiwan and Singapore, have been hit hard by the crisis and their investment abroad has declined significantly.

A domestic industry with less exposure to international fluctuations is important. Thus, Vietnam should continue to bet on its rural sector. It still is the country's main employer, and while it is shifting rapidly from a subsistence sector to a cash crop industry, careful planning will provide a fall-back position for farmers when the foreign markets cave in. For this to occur, product flexibility and a wide product mix are key requirements.

Furthermore, regional markets for agricultural products are bound to expand, reducing the dependence on U.S., Japanese or European markets for a few luxury products such as shrimp. With growing populations and rapid industrialization, China is projected to import increasing amounts of rice and other cereals. Cost-competitive Vietnam should be able to benefit from this development without massive changes in its own societal and economic structure.

The government must assure that the agricultural sector does not get run over by rapid development of the *industry du jour* at the expense of time-proven products. As Vietnam's agricultural sector evolves and becomes more financially successful, it will develop into higher efficiency production systems naturally, just as Western farmers did. Diversification into non-agrarian sectors will occur and is nothing to be afraid of.

The proper mix of agriculture and new industries requires planning and government involvement to assure sustainability. Leaving it to the market would only

flood Vietnam, with its cheap labor and eager workers, with foreign investors who are in it for the short haul, leaving the country exposed to market fluctuations similar to those that have brought down the government in Indonesia. One must never forget that a bad economy represents dramatically different consequences for a farmer or worker living at the bare minimum required for survival than for someone in the West with crop insurance, unemployment benefits and other social safety nets to prevent the worst.

As this paper has argued, agriculture should not be seen as a remnant of days past, but as a significant contributor to economic development and social stability. It is the nation's social security and the economic driver at once. The challenge is not to sacrifice it to proclaimed requirements of the World Trade Organization or Western economic thought, but to integrate it into and make it part of a healthy, diversified overall economy.

CHAPTER 8

CONCLUSION

This final, brief chapter revisits the themes laid out in the beginning of this thesis. The broad relevance is clear, since agriculture in Vietnam is inseparably linked with environmental sustainability, trade, technological change and distribution of the spoils of growth.

Vietnam's farmers are defenders of their *environment*, as Broad and Cavanagh assumed they would be. But they do so not because of a belief in an intrinsic value of environmental protection, but out of personal benefit. Where environmental destruction serves their purpose (or appears to do so), they will abandon their stewardship over the land and engage in destructive practices. The overintensification of shrimping and the associated destruction of mangroves serves as an example of the willingness of farmers to destroy the natural habitat they have used for generations under the illusion of profits to be made. Grossman may be right when he argues that for real environmental protection independent of a profit motive, people have to reach a certain level of financial security.

As for the issue of market distortion and the associated environmental destruction, this problem does not seem to have taken hold of Vietnam yet. Most agricultural production is not undertaken because of subsidies or other artificial incentives, but out of a true desire to produce and sell at true costs. Nevertheless, with international corporations and donor organizations pitching chemicals and fertilizers to Vietnamese exporters, market distortions from subsidized inputs are a distinct possibility.

Overproduction already occurs in the rice sector, due to the government's "buy-all" policy. Thus far, rice is produced in a relatively environmentally sound manner in

Vietnam, so that little negative effects follow from this policy. But with intensified production, this situation could change for the worse.

As the paper points out, *sustainability* must be the main goal of Vietnam's agriculture policies. The traditional ways of producing surplus production in integrated agricultural smallholder systems are sustainable, but growth is needed to feed the increasing number of mouths in rural communities. Thus, rather than criticizing growth models, the issue in Vietnam is to manage growth sustainably and of course assure that it accrues to all of society, rather than to a small elite alone.

Where *trade* is based not on extraction but on harvest, in other words, on renewable resources, it is difficult to see how trade in these products would make the Vietnamese poorer, as Daly asserts. It appears that Daly's theory about no-growth development is applicable to the First World, but in a country with severe underconsumption, growth remains a necessity.

Even if economic systems could be found that sustain the present standard of living for the increasing population in Vietnam, such a policy would be impossible to sell to a poor but industrious people striving for more. The desire and, I would argue, the need for growth in Vietnam is a given. Any argument to the opposite would be lost on the Vietnamese — naturally on those looking towards the West for guidance, but even on traditional farmers who want a better life.

Trade will inevitably play a large role in Vietnam's growth and development. If the world trade regimes currently under construction indeed reduce world subsidies on agricultural products, French will be proven right in her opinion that Third World countries stand to gain. Vietnam has a competitive advantage over wealthier countries in

a variety of food products. All things being equal, the nation stands to export large amounts of basic food to neighboring China and luxury items, such as shrimp and prawns, to Japan, Europe and the United States.

On the *technology* front, Vietnam could dodge the problems that Hobbelink and Islam predict. Its agriculture is based on labor-intensive mass crops. Rice is still hard to plant, transplant and harvest mechanically, and labor is cheap enough in Vietnam to make its production more than competitive with more industrialized competitors in Thailand and the United States. Fish can also be raised with little technology, and the harvest can be improved with altered techniques that do not require high capital investment up front.

As this paper argues, Vietnam can intensify its agriculture through integration, which is inherently a yield-enhancer based on labor, not machinery. The main reason why integrated farming has all but disappeared in the First World is that mechanization is difficult in multi-crop fields. If Vietnam follows the policy recommendations and predictions in this paper, technological change will not be a problem on the scale it is predicted to be for other nations.

The main fear in this context is the potential of gene and biotech technology to improve the competitive position of high-tech mass producers over the Vietnamese smallholder. But, as Islam points out, biotechnology and genetic engineering at least do not show a regressive cost curve with respect to production quantity, so that small farmers could benefit as much per unit produced as the large corporate entity.

With reference to *distribution*, Vietnam will face problems in the coming years and decades. As research has shown in the past, export production tends to speed up the trend of land concentration in the hands of elites, with the associated negative social

effects on the rural populations. Cash crop production increases land value and drives slow adopters of new products and better techniques into difficult positions.

The fact that land is not freely tradable could help poorer farmers hold on to their land, but at the expense of overall efficiency. The government is often criticized for having given up the communist ideals of equality for free market fervor. Indeed, where a clear-cut choice between social values and profit exists, the government is frequently siding with the advocates of a positive bottom line. As a consequence, landlessness has emerged as a problem, not surprisingly where profitable export farming of shrimp is common.

Overall, this paper has painted a positive picture of Vietnam's possibilities. Due to its late entry in the global economy and its rapid pace in catching up, Vietnam will continue to be a research laboratory for the themes mentioned in this paper and many others.

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