Transaction Costs of Agri-Environmental Policies in Vietnam

Laura McCann
Agricultural and Resource Economics
University of Western Australia
35 Stirling Highway
Crawley, WA 6009

Work in progress, not for quotation

Abstract

Vietnam faces a number of important environmental and resource issues including deforestation, loss of biodiversity, and water and air pollution. In developing countries the conflict between growth and protecting the environment is particularly acute. This paper provides an overview of existing agri-environmental policies and institutions in Vietnam. It then analyses policy instruments that have been employed to reduce pesticide pollution and discusses the factors affecting the magnitude of transaction costs associated with those policies. A major factor is the large number of micro-enterprises involved, both farms and input suppliers.

Key words: agri-environmental policies, transaction costs, Vietnam

Contributed Paper presented at the 45th Annual Conference of the
Australian Agricultural and Resource Economics Society
23-25 January 2001, Adelaide South Australia.

Recent studies of transaction costs of agri-environmental policies have shown that the magnitudes of these costs are important and should be incorporated in economic evaluations of policies (McCann and Easter 1999, Falconer and Whitby 1999). There has been little work on the transaction costs of policies in developing countries. This paper discusses the issues involved with transaction costs of agri-environmental policies, and pesticide policies in particular, in Vietnam.

Fundamentally, transaction costs depend on institutions (North 1990) therefore it is also possible to delve deeper and look at the causes of institutional change. For example, some studies look at the political economy of how agri-environmental policy is made (Potter 1998). Alston (1996) discusses institutional change in terms of demand and supply. He highlights the importance of examining the power of demanders and suppliers (usually government) of institutional change. While beyond the scope of this paper, such a framework could be used to examine the outlook for institutional change in Vietnam with respect to agri-environmental policies. In order to do that, one would need to specify the demanders and suppliers and their power situation. Potential demanders could be farmers, international donors, or NGO's. If government is the supplier, an important question in Vietnam is which level(s) of government is (are) important, central, provincial, or district? To predict what will happen one would also need to look at who would be interested in blocking change. While these issues are not discussed in a formal institutional change framework, they are touched on in the rest of the paper.

Policy situation

There is significant donor funding for agricultural and environmental projects and it seems that some of the impetus for environmental policy has come from the international community. An International Union for the Conservation of Nature (IUCN) report (1998) indicates that Vietnam may have reached its capacity to absorb international aid. In 1999 there were ongoing environmental overseas development assistance (ODA) projects totalling U.S. $1.4 billion (with an average budget of $8 million) which is a six-fold increase over 1995. Vietnam has ratified a number of international environmental treaties, for example the 1992 Convention on Biological Diversity (IUCN 1998). The National Plan was developed in 1991 by the State

Committee for Sciences in conjunction with the United Nations Environmental Program (UNEP), the United Nations Development Program (UNDP), the Swedish International Development Authority (SIDA), and IUCN. In a discussion on the subsequent law, Dr. Nguyen indicates that "the promulgation of the Environmental Protection Law also serve the policy and foreign invested projects in Vietnam as well as the international cooperation in the environmental protection" (1998, p. 228).

Vietnam has a number of environmental policies in place. As indicated above, the State Committee of Science, now the Ministry of Science, Technology and Environment (MoSTE), developed the National Plan for Environment and Sustainable Development 1991-2000, preceding the recent high growth in industry. The document focused on point source polluters, but also addressed some non-point issues. The National Plan indicated that while chemical pesticide use was not high, there had already been some negative effects on freshwater fisheries. It recommended that IPM should be promoted and that regulations regarding the storage, transportation, handing and use of pesticides should be developed and that the types of pesticides available should be restricted (SCS 1991). A year after the National Plan, in 1993, the Law on Environmental Protection was passed (Le 1998). Article 9 says that all activities that result in environmental degradation are prohibited. According to the Land Law of Vietnam 1993 under Chapter IV, Rights and Obligations of the Land User, Article 79 says farmers have an obligation "To comply with regulations on environmental protection, not causing damage to the legal interests of adjacent land users".

There are several aspects of Vietnamese environmental policy that are common to other countries. While these laws look good on the books, they are really only as good as the capacity and will to enforce them. Vietnam lacks the capacity to fully implement their environmental policies (Boer 1998). Christoplos (1995), regarding extension policy said that one sees pragmatic blends of policy, not policy implementation. As in many other countries, the responsibility for the environment and natural resources lies in a number of agencies. The National Plan recommended that a supra-ministerial body be established but this was not implemented although a new ministry, MoSTE was established, which includes the National Environment Agency. In addition to MoSTE, agri-environmental

policy would also be governed by the Ministry of Agriculture and Rural Development while the Ministry of Finance is involved with any taxes. Again, similar to other countries, MoSTE has less power than other ministries (Miller et al. 1999). At the provincial level, there are Departments of Science, Technology and the Environment and Departments of Agriculture and Rural Development. These report to the Provincial People's Committees in the first instance so the links between the central government ministry and the provincial department are not very strong and it remains primarily a case of information exchange (IUCN 1998). There is also the fact that these laws are at the central government level and enforcement varies by province. Provincial People's Committees are autonomous as implementation authorities (SCS 1991) and can draft their own environmental regulations (IUCN 1998). Therefore the provincial level of government is probably the most important as far as agri-environmental policy. This can be seen as a continuation of the inability of the central authority to control local decision-making (Fforde and deVylder 1996), rather than a completely new phenomenon. Central government regulations are sometimes based on provincial regulations (Tran, pers. comm.). This is similar to the U.S. in that often experimentation at the state level is the basis for national regulations (Ringquist 1993).

Transaction costs

This study explores policies to reduce pesticide use from a transaction cost perspective. Measurement of transaction costs related to agri-environmental policies is quite new and measurement techniques are still being developed. For policies that already exist examination of existing data is possible and probably the most reliable option (Falconer and Whitby 1999, McCann and Easter 2000). For cases where policies are not yet in place, or where the data collection procedures do not account for all costs involved, a survey is required (McCann and Easter 1999). In general the typical method for non-market costs is to estimate time spent and then value that time (Kuperan et al. 1998, Feeny 1998, McCann and Easter 1999). Feeny (1998) brings up the issue that valuing time for farmers may be difficult. If they derive benefit from going to extension meetings and interacting and socializing with other farmers, this should be accounted for. In a study of integrated pest management (IPM) in Vietnam, Chung and Dung (1996)

mention that farmers enjoyed the IPM meetings and the opportunity for interaction that it afforded. It is also the case that often the time was spent in the distant past or the future so the estimates from interviews may be inaccurate. One also needs to make sure that one is comparing the best design for both policies, not a good design for one policy and a poor one for another. Taxes can be implemented at the factory level while standards may well have to be at the farm level. If one assumed that taxes were implemented at the farm level, that would increase the measured transaction costs and thus bias the results.

The structure of transaction costs is also important. Types of TC involved with environmental policies can be categorized into research, information gathering and analysis (R), enactment of enabling legislation including lobbying costs (E), design and implementation of the policy (D), support and administration of the on-going program (S), monitoring/detection (M), and prosecution/inducement costs (P). The magnitude of transaction costs involved with an environmental policy is thus represented by the sum of these costs (McCann and Easter 1999).

Clarifying the determinants of transaction costs is important in designing policies that minimize transaction costs. Cultural norms and institutions will affect the transaction costs of policies so we would expect differences between the United States or Australia, and Vietnam. Another factor that should be taken into account in the design of policies is the potential for abuse or rent seeking which may depend on social capital. Another difference in Southeast Asian countries is the number of people involved. The number of farmers is a determinant of TC for some policies (McCann and Easter 1999). It may be that fixed costs, such as for design of legislation, would be similar but variable costs would be much higher. The number of farmers in the U.S. is only about 4 million although they are spread out. In Vietnam the number of farmers is 56 million and while they are located on small parcels and thus located physically close to each other, transport systems are poorly developed in many areas. In addition, government resources such as transport for extension personnel are severely limited in Southeast Asia (Pingali and Rola 1995). These factors would indicate that transaction costs will be higher for developing countries than developed countries and these same factors are related to the fact that one expects transaction costs to be higher for non-point source pollution than

point source pollution.

The Pesticide Issue

There have been numerous studies about pesticides in Southeast Asian countries and their effect on farmer health (Antle and Pingali 1994, Nguyen and Tang 1999). Modernization of agriculture represented by increased market orientation has increased pesticide use throughout the region. Data for Vietnam from the Department of Plant Protection show that pesticide use has increased from 20,300 tons in 1991 to 42,447 tons in 1998. In general they have found that farmers overuse pesticides compared to the economic optimum when health effects are accounted for. Given that this is an on-farm effect, the fact that this overuse continues is puzzling. According to a recent review article (Matteson 2000) IPM specialists have come to the conclusion that "insecticides are usually not needed in rice" (p 553). Studies in the Mekong Delta have found that farmers who have rice/shrimp systems use less pesticides than farmers who only produce rice (Tran 1994). This indicates that they are aware of the negative impact of pesticides on shrimp. Mekhora (2000) has found this to be the case in Thailand as well. While studies in developed countries have focused on pesticide residues in food, in Southeast Asia health problems are the main concern (Pingali and Rola 1995). Due to the high temperatures, pesticides tend to degrade more rapidly so environmental problems are also less of a concern. In Vietnam there is little hard data on the effects of pesticides on fish and shrimp or on residue levels in agricultural products. One legacy of communism is an emphasis on production targets rather than any measure of economic efficiency or profitability. This emphasis tends to promote monocropping which is not necessarily the most profitable strategy for farmers and also exacerbates agri-environmental problems.

The issue then becomes, what are the appropriate policy responses? IPM training has been conducted in all provinces of Vietnam in the 1990's and this seems to have been successful. Most of the effort has concentrated on rice but there is interest in working on IPM for vegetables (FAO 2000). Pingali and Rola (1995) indicate that because IPM is knowledge intensive and location specific, the technical and administrative resource requirements are large. In addition, several authors have suggested input taxes (Antle and Pingali 1994, Nguyen and Tran 1999), bans (Pingali and Rola 1995), as well as

safety standards, improved packaging and labeling and industry promotion of safer pesticides. A significant concern with policies to reduce pesticide use is whether this will result in decreased productivity but Pingali and Rola (1995) find that this is not as significant as one might expect due to the ability to substitute other pesticides and change management practices. They indicate that many studies show that policy makers overestimate losses from insect infestations compared to farmers who in turn overestimate losses compared to actual losses.

Bans The Plant Protection Department has banned certain pesticides, including all Category 1 pesticides (the most hazardous according to the WHO classification system) since 1995. At that time research and information costs, enactment costs, and design and implementation costs would have been incurred. Each year the list of banned, restricted, and permitted pesticides is revisited (MARD 2000). Research/information and decision-making costs as well as support costs are thus incurred each year. Pingali and Rola (1995) suggest that effectiveness should be considered when government is making decisions about what pesticides to register. For example a category I pesticide that isn't very effective should perhaps not be imported at all, banned in other words. In Vietnam, both efficacy and environmental/health effects are taken into account (Nguyen Huu Huan, pers. comm.). A number of people indicated that some Category 1 pesticides are smuggled in from Cambodia and China so monitoring and enforcement costs are incurred. One advantage of bans is that enforcement is more straightforward than when an allowed pesticide has been misused (Easter 1991).

Tax Currently there is no tax in place that is designed to reduce pesticide use. The Ministry of Finance has taxes on some pesticides (#3808 of tax code) but given the levels involved, it is designed to raise revenue rather than affect behavior. The rate for fungicides and herbicides is 1%. The rate for insecticides varies. A rate of 10% is applied to Fenobucarb with less than 96% active ingredient while a rate of 0% is applied if the active ingredient is greater than 96% (the formulation that is produced in Vietnam). Other insecticides are taxed at either 0% or 3% but the law provides little guidance as to which insecticides attract which rate. The money collected goes to the general budget.

Transaction costs affect and are affected by a number of design and

implementation issues. Any effective tax would be at a much higher rate than the current situation, for example Nguyen and Tran (1999) found a rate of 33.4% was required although this seems conservative. Their findings were based on the negative health effects but there are negative environmental effects, such as the effect on shrimp production, that are not accounted for in their research. The Ministry of Finance tried to impose a 5% tax on pesticides but the decision was reversed due to the opposition of the pesticide companies. There had been no consultation with MARD or MoSTE so there was little scientific justification and the multinationals were able to argue against it. Obviously if a tax at a level designed to change farmer behavior is to be enacted, it will need to address this opposition. Solid scientific and economic evidence would need to be presented and there would need to be coordination between MARD, MoSTE, and the Ministry of Health as well as the Ministry of Finance. At this stage research and information costs as well as design costs would be incurred. There would also be opposition to a tax due to the perceived equity and production consequences. Farmers are currently facing very low prices for rice, about 1050 d/kilo which Christensen (pers. comm.) suggested was actually lower than production costs. Imposing a tax when prices are this low would be a problem and this has consequences for enactment/lobbying costs. In the Mekong Delta pesticides account for less than 7% of total costs. Since not all pesticides would be affected and since farmers would be able to switch to other pesticides as well as other management techniques, cost increases would be small and when health effects are accounted for, they would actually gain (Nguyen and Tran 1999).

Tax rates should be adjusted to account for the magnitude of the environmental and health effects caused by the pesticides. Given that certain pesticides are more hazardous to human health, i.e. insecticides are more hazardous than fungicides or herbicides, and that among insecticides some are more hazardous (Category I and II) than others (Category III and IV) a tax should not be uniform across pesticides. Since most herbicides and fungicides are in categories III and IV, it would be feasible to restrict taxes to Category II pesticides (Category I being banned already). Since these categories are determined by WHO, the decision-making process in Vietnam would be simplified. Rather than basing arguments on economic efficiency, taxes could be promoted as a way

to equalize costs between safe and unsafe pesticides since the latter are usually cheaper.

The transaction costs will obviously depend on at which point the tax is levied. The most efficient design would be for these taxes to be levied at the factory or at the point of importation by the central government, rather than collected at the supplier or farmer level. The tax would then be passed on to the distributors and ultimately the farmers. In Cantho Province alone there are 250,000 farms and 600 pesticide sales agents. The other issue that arises is that because of smuggling of Category 1 (usually banned) pesticides from Cambodia and China, farmers may actually switch to these pesticides from the registered pesticides. A tax would need to be implemented in conjunction with increased enforcement of border smuggling or increased monitoring of pesticide sales agents for banned pesticides. Since a small tax already exists, the marginal costs of implementation would be lower than otherwise. As with the ban, there are no wider benefits of the policies than reductions in damages from pesticide use.

Nguyen (personal communication) suggests that tax revenues should be returned to farmers. A lump sum transfer to farmers would be administratively costly. Another option would be to subsidize the development or use of a mitigating input, perhaps pest resistant rice varieties, or use the money to fund IMP education programs. This highlights the fact that there would also be costs involved with deciding how these funds would be used, particularly if they are to be earmarked for environmental or development efforts in rural areas.

For countries with limited sources of revenue, input taxes may be particularly attractive and subsidies particularly onerous. As reported in Matteson (2000), Indonesia phased out an 85% pesticide subsidy in the late 80's which saved U.S. $100,000/year and reduced pesticide applications per season from 4 to 2.5. Taxes have an advantage over regulations in that they raise revenue and Vietnam’s ability to tax income is limited. It may also be that this would provide an incentive for governments to fully implement the policy. Collection of taxes is probably also easier to monitor than compliance with regulations which would tend to limit corruption.

Media Campaign Given that the input supply industry uses the media extensively to promote pesticide use (Matteson 2000), there are two different policies

that could be implemented. One would be to regulate the content of advertising so that it isn't misleading. The effect of regulating advertising might be higher than in Australia or the U.S. because the populace is less well educated. The media can also be used to directly influence pesticide applications. A media campaign was conducted in Long An Province in the Mekong Delta and a careful study of the program's effectiveness was carried out (Escalada et al., 1999). The researchers conducted a randomized baseline survey, a media campaign telling farmers not to spray for leaf folder insects in the first 40 days after sowing, and follow-up surveys. Media used were a leaflet, a poster, and a radio drama and they reached 97% of farmers in the study area (and 82% of the farmers in the other 12 districts in Long An Province). Farmers reduced spraying from 3.35 sprays per season to 1.76 sprays per season with most of the reduction coming early in the season. According to farmers, the main motivation for changing was reduced pesticide costs and labor. The media campaign was most effective in changing weakly held attitudes. Follow-up campaigns were conducted in 15 provinces reaching 2 million farmers at a cost of U.S. $151,000.

Most of the transaction costs would involve design and implementation costs since they rely on existing information and it is voluntary so while some monitoring of effectiveness would occur, there wouldn't be any enforcement costs. To some extent, this information merely counteracts the information provided by those with an interest in increasing pesticide use. Mai et al. (1997) indicated that there was aggressive marketing by chemical companies and also that pesticide use was encouraged by government programs designed to increase rice production. Several people indicated that extension staff often earned extra money by selling inputs to farmers which would tend to bias the information that they provide.

There were also Farmer Field Schools held in Long An Province, with 8.7% of the farmers in the study sites having participated. Application frequencies were not significantly different between the farmers that had been exposed to the media campaign and attended the FFS, compared to farmers who had only been exposed to the media campaign (Heong et al. 1998). Another study in the Mekong Delta (Huan et al. 1999) found that mean application frequencies per season were 2.07 for farmers not exposed to

the media and not FFS trained, 1.20 for farmers exposed to the media, and 0.54 for farmers exposed to both the media and FFS. Increased effort thus results in increased reductions in pesticide use but at higher cost.

Integrated Pest Management The FAO funded IPM program that has been implemented in Vietnam stems from research facilitated by IRRI and a "farmer first" extension paradigm that was first fully developed in Indonesia (Matteson 2000). Rather than just decreasing pesticide use, they see the farmer field schools (FFS) and community IPM as farmer-led community development, which is a much broader and more ambitious goal than just reducing health and environmental impacts of pesticide use. In Vietnam, the program was launched in 1992, with the number of FFS peaking in 1996. The program is implemented through the Plant Protection Department rather than the National Extension Service. As of March 1999, 43 Train the Trainers courses have graduated 1486 people. The farmer field schools have reached 400,000 farmers or 5% of the farming households in Vietnam. It seems that the IPM program was originally a supply push situation but given its success it is now in high demand. As evidence of this, 9616 of the FFS have been funded by FAO and 5740 have been locally funded (FAO 1999). FAO funding is being reduced but DANIDA (the Danish development organization) has just started a five year follow-up project with a goal of training 174,000 farmers in 7000 field schools at a cost of U.S. $8.5 million.

Studies have shown that in addition to reducing or eliminating pesticide use, fertilizer and seed costs are reduced while maintaining rice yields and decreasing yield variability (Matteson 2000). There is anecdotal evidence that farmers are once again able to produce fish in their fields (Matteson, pers. comm.). The fact that IPM education efforts in Vietnam seem to have been quite successful in decreasing pesticide use while increasing profits (Nguyen and Tran 1999, Chung and Dung 1996) would seem to indicate that farmers did not have perfect information as to the effects of pesticides on productivity, health and beneficial insect populations or were not behaving rationally previously. To an economist these results are quite puzzling. There are several possible explanations for this, selection bias, bounded rationality, and government pressure. In studies of program effectiveness, farmers who have attended IPM training were

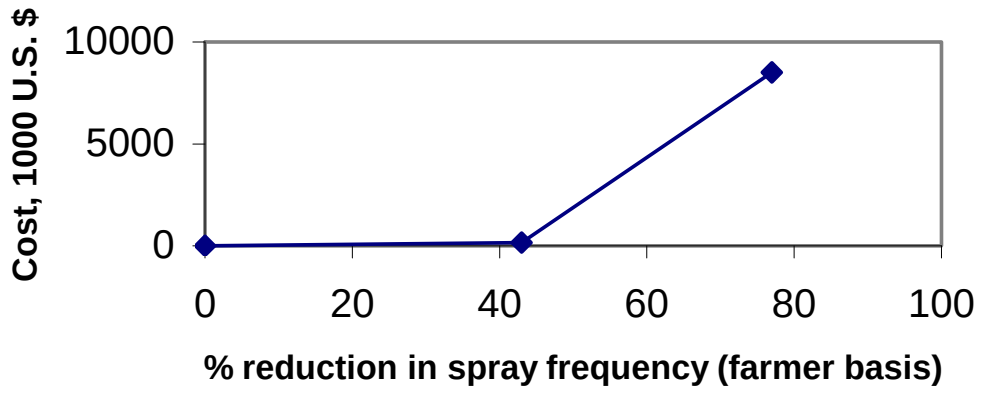
compared to those who had not received the training. These studies were flawed because the choice of participants for the FFS wasn't random, even though it did conform to good extension practice. In general, provincial officials nominated the better farmers to participate in the program so selection bias would mean that better managers would typically be better at crop management and therefore more profitable. Bounded rationality is an issue in two respects. The complexity of IPM means that farmers have difficulty implementing all the recommendations so benefits will be lower than expected. Bounded rationality could also explain why the farmers were not allocating inputs so as to maximize profits in the first place. Given government pressure to achieve production targets and pressure from chemical companies and extension agents that also sell inputs, participating in the program may have in some sense given farmers permission to optimally allocate inputs and maximize profits. It seems that this, and selection bias are the most likely explanations for the observed data.

Similar to the observation that scientists are usually concerned with maximizing yields, scientists and extension educators are also concerned with maximizing effectiveness/ results of programs and not necessarily cost effectiveness or efficiency. As indicated earlier, ODA to Vietnam has been quite significant and probably exceeds the absorption capacity. This would tend to suggest that funds are not necessarily used as efficiently as if there were a binding constraint. This suggests that government failure is an issue. It may be that this is a Cadillac program when a Vesta is what's needed.

Transaction costs are concentrated in the implementation stage. Some adaptive research was required when the program was introduced into Vietnam but less than if it had been developed from scratch. Enactment costs were probably fairly low although there would have been deliberations with government officials and a scoping study was carried out in 1990. Design and implementation costs included development of a curriculum based on the Indonesian experience and the research and pilot studies carried out in Vietnam. Actually conducting the FFS is quite costly and depends on the number of farmers trained. Some studies monitoring the effectiveness of the program are carried out but as with other voluntary programs, there are no enforcement costs.

If one compares the costs of the media campaign versus the IPM program (based on the DANIDA program costs) on a per farmer basis, the media campaign is much more attractive. Cost is U.S. $ 0.08/farmer for the media campaign versus U.S. $48/farmer for the IPM program. In each case, the programs built on previous programs in Vietnam so the research, information, enactment and design costs would have been negligible or reduced. If one plots a graph of abatement (% reduction in pesticide use based on Huan et al. 1999) versus transaction costs for the status quo situation, the media campaign and the IPM program, it resembles the familiar increasing marginal cost of abatement diagram. It should be noted that some of these costs might actually be abatement costs.

Fig. 1. Transaction Costs for Pesticide Reduction Programs



Conclusions

The previous discussion suggests that the IPM program is not the most efficient way to reduce pesticide use. However, given the very different aims of a ban or a tax compared with the broad aims of IPM which range from sustainable development to empowerment of farmers, cost-effectiveness is not the appropriate framework for a comparison of policies. In developed countries, it seems that the goals of IPM are more narrowly focused on reducing pesticide use or residues. Investment analysis concepts including net present value and internal rate of return should be used. As with most analyses, the costs will be easier to estimate than the benefits. Particularly for the more

social aspects of the IPM program benefit estimation will be difficult. It is also the case that design of all policies should emphasize decreasing costs, including transaction costs, and increasing benefits. This requires a careful analysis of policy details as discussed in McCann (2000).

Research, enactment, and design costs will generally be fixed costs for any particular policy. It is the implementation and monitoring and enforcement costs that will increase as the number of farms and/or suppliers increases although for bans, taxes and media campaigns, this would be small. Thus, the efficiency advantages of taxes will be enhanced relative to regulations. Consolidation will reduce these costs since it reduces the number of farmers that the government needs to monitor or interact with.

References:

Alston, Lee J. 1996. "Empirical work in institutional economics: an overview". In: Empirical Studies in Institutional Change, Lee. J. Alston, Thrainn Eggertsson, and Douglass C. North, eds. Cambridge University Press.

Antle, John M. and Prabhu L. Pingali. 1994. "Pesticides, Productivity and Farmer Health: A Philippine Case Study". *American Journal of Agricultural Economics* Vol. 76, pp 418-430.

Boer, Ben, 1998. "Environmental Law and Sustainable Development in Vietnam", Vietnam Workshop on Agriculture, Natural Resources and the Environment, University of Sydney, February 1998.

Chung, D.K. and K.T. Dung. 1996. "Pest Management in Rice Production in Vietnam: A Socioeconomic Assessment" Faculty of Economics and Rural Development, Hanoi Agricultural University.

Christoplos, Ian. 1995. "Paradigms, Policy and Privatization in Vietnamese Agricultural Extension. Working Paper 275, Int'l Rural Development Centre, Swedish Univ. of Agricultural Sciences, Uppsala.

Easter, K.W. 1991. "Differences in the Transaction Costs of Strategies to Control Agricultural Chemical Offsite and Undersite Damages" Dept. of Agricultural and Applied Economics, Univ. of Minnesota, Staff Paper 91-42.

Escalada, M.M., K.L. Heong, N.H. Huan, and V. Mai. 1999. "Communication and Behavior Change in Rice Farmers' Pest Management: The Case of Using Mass Media in

Vietnam". *Journal of Applied Communications* Vol. 83 (1) pp. 7-26.

FAO, 1999. Vietnam National IPM Programme.

FAO, 2000. Baseline Survey: Vegetable Production in Vietnam. Vietnam National IPM Programme.

Falconer, Katherine and Martin Whitby. 1997. "Disaggregating Transaction Costs for Countryside Stewardship Policies: The Case of Environmentally Sensitive Areas" Paper to the Agricultural Economics Society Conference on Designing Agri-environmental Policy Mechanisms: Theory and Practice. 2 December, 1997.

Feeny, David. 1998. Chapter 8. "Suboptimality and Transaction Costs on the Commons" In: Designing Institutions for Environmental and Resource Management, Edna Tusak Loehman and D. Marc Kilgour, eds.

Fforde, Adam, and Stefan de Vylder, 1996. Chapter 2 "Historical Context" In: From Plan to Market: The Economic Transition in Vietnam Westview Press.

Heong, K.L., M.M. Escalada, N.H. Huan, and V. Mai. 1998. "Use of communication media in changing rice farmers' pest management in the Mekong Delta, Vietnam" *Crop Protection* Vol. 17 (5) pp. 413-425.

Huan, N.H., V. Mai, M.M. Escalada, K.L. Heong. 1999. "Changes in rice farmers' pest management in the Mekong Delta, Vietnam" *Crop Protection* Vol. 18, 557-563.

IUCN, 1998. "Environmental Management Issues and Concerns in Vietnam: An Appraisal" International Union for the Conservation of Nature.

Kuperan, K., N.M.R. Abdullah, R.S. Pomeroy, E.L. Genio, A.M. Salamanca. 1998. "Measuring Transaction Costs of Fisheries Co-Management" Presented at the 7th Common Property Conference of the International Association for the Study of Common Property, 10-14 June 1998, Vancouver Canada.

Le, Qui An, 1998. "Environmental Strategy of Vietnam" In: Environment and Bioresources of Vietnam: Present Situation and Solutions Cao Van Sung, Ed. The Gioi Publishers, Hanoi.

Mai, V., N.H. Huan, K.L. Heong, M.M. Escalada, and A.A. Lazaro. 1997. Chapter 15 "Pest management perceptions and practices of rice farmers in Long An Province, Vietnam" In: Pest Management of Rice Farmers in Asia Heong K.L., and M.M. Escalada, eds. International Rice Research Institute.

MARD. 2000. "List of Pesticides Permitted, Restricted and Banned to Use in Vietnam"

Hanoi

Matteson, P.C., 2000. "Insect Pest Management in Tropical Asian Irrigated Rice" *Annual Review of Entomology* Vol. 45: 549-574.

McCann, L.M.J. and K.W. Easter, 1999. "Evaluating Transaction Costs of Nonpoint Source Pollution Policies" *Land Economics*, August 1999, Vol. 75(3).

McCann, L.M.J. and K.W. Easter. 2000. "Estimates of Public Sector Transaction Costs in NRCS Programs". *Journal of Agricultural and Applied Economics* Vol. 32(3), 555-563.

McCann, L.M.J. 2000. "Lessons from Agri-Environmental Policy in the United States" 44th Annual Conference of the Australian Agricultural and Resource Economics Society, Sydney, January 2000.

Mekhora, Thamrong. 2000. Production Efficiency in Thailand's Rice and Shrimp Industry. Ph.D. Thesis. University of Western Australia

Miller, Fiona, Nguyen Viet Thinh, and Do Thi Minh Due, 1999. "Resource Management in the Vietnamese Mekong Basin" Working Paper # 74, National Library of Australia.

Nguyen, Dac Hy. 1998. "Environmental Protection Law in Vietnam: Discussion" In: Environment and Bioresources of Vietnam: Present Situation and Solutions Cao Van Sung, Ed. The Gioi Publishers, Hanoi.

Nguyen, Huu Dung and Tran, Thi Thanh Dung. 1999. "Economic and Health Consequences of Pesticide Use in Paddy Production in the Mekong Delta, Vietnam". Economy and Environment Program for Southeast Asia, Research Report Series. Singapore.

North, Douglass C., 1990. Institutions, Institutional Change, and Economic Performance Cambridge University Press.

Pingali, P.L. and Rola. 1995. Chapter 14. In: Impact of Pesticides on Farmer Health and the Rice Environment Prabhu L. Pingali and Pierre A. Roger. Kluwer Academic Pub.

Ringquist, Evan J. 1993. Environmental Protection at the State Level: Politics and Progress in Controlling Pollution. M.E. Sharpe, New York.

SCS. 1991. National Plan for Environment and Sustainable Development 1991-2000 Framework for Action.

Tran, Thanh Be. 1994. "Sustainability of Rice-Shrimp Farming System in a Brackish Water Area in the Mekong Delta of Vietnam" M.S. Thesis, Univ. of Western Sydney-Hawksbury.

UNDP, 1999. Compendium of Environmental Projects in Viet Nam 1999. United Nations Development Programme, Ha Noi.