Growing Rice and Protecting Forests: An evaluation of three food production projects in S E Asia

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Growing Rice and Protecting Forests: An evaluation of three food production projects in S E Asia

FINAL REPORT

June 1999

The views expressed in this report are those of the evaluation team and not necessarily those of AusAID.

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The contents of this report represent the views of the study team as formed through interviews, discussions, observations and review and analysis of the data and reports, over a 7 week period between August and October 1998. It does not necessarily represent the views of AusAID or the partner countries. It must be noted that all projects evaluated were implemented at a time when environmental guidelines were being developed by AusAID and the World Bank. Both AusAID and the World Bank now have guidelines in place and adherence to them is now required of all contractors.

ACRONYMS

ADB	Asian Development Bank
APB	Agriculture Promotion Bank
AUD	Australian Dollar
AusAID	Australian Agency for International Development
BPH	Brown Plant Hopper
CARDI	Cambodian Agricultural Research and Development Institute
CIAP	Cambodia-IRRI-Australia Project
CLRRI	Cuu Long Rice Research Institute
DAP	Di-ammonium phosphate
DAS	District Agriculture Service
DIS	District Irrigation Service
DOI	Department of Irrigation
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FAO	Food And Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GOA	Government of Australia
GOV	Government of Vietnam
ID	Implementation document
IDA	International Development Agency of the World Bank
IMF	International Monetary Fund
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
IUCN	International Union of Conservation of Nature

LUADP	Lao Upland Agriculture Development Project
LWU	Lao Women's Union
MAF	Ministry of Agriculture and Forestry, Lao PDR
MAFI	Ministry of Agriculture and Food Industry, Vietnam (now MARD)
MARD	Ministry of Agriculture and Rural Development, Vietnam
MOTCP	Ministry of Transport, Communications and Post
MOU	Memorandum of Understanding
NGO	Non government organisation
PAS	Provincial Agriculture Service
PCR	Project Completion Report
PID	Project Implementation Document
SAR	Staff Appraisal Report
t/ha	tonnes per hectare
TA	Technical Assistance
UNDP	United Nations Development Programme
USD	United States Dollar
VASI	Vietnam Agricultural Science Institute
WUA	Water Users Association
WUG	Water Users Group

UNITS AND CURRENCY CONVERSIONS

The units used in this report are:

hectares	ha
rai	40 metres by 40 metres
kilometres	km
metres	m
Litres	L
kilograms	kg
tonnes	t

Average mid-rates for year against Australian (AUD) and US (USD)

Year	Australian dollars	US dollars	Cambodian reils	Vietnamese dong	Lao PDR kip
1990	1.000	0.7734	323	3879	548
1991	1.000	0.7599	534	6900	534
1992	1.000	0.6873	871	7704	492
1993	1.000	0.6775	1822	7351	485
1994	1.000	0.7770	1978	8549	559
1995	1.000	0.7452	1826	8214	641
1996	1.000	0.7968	2091	8805	726
1997	1.000	0.7524	2084	8790	1619
1990	1.293	1.000	418	5016	709
1991	1.316	1.000	703	9080	703
1992	1.455	1.000	1267	11209	716
1993	1.476	1.000	2689	10850	716
1994	1.287	1.000	2545	11003	720
1995	1.342	1.000	2451	11023	860
1996	1.255	1.000	2624	11050	943
1997	1.329	1.000	2770	11680	2152

Source:

Asian Development Bank, *Key indicators of developing Asian and Pacific Countries*

EXECUTIVE SUMMARY

The 1998 AusAID environment cluster evaluation required an examination of environmental impacts of food production projects as well as particular issues such as food security and gender issues. The four projects selected were: the Cambodia-IRRI-Australia Project, Phases I-III (1987-1996), the Vietnam-IRRI Rice Research and Training Project (Vietnam-IRRI) (1985-1994), the Bangladesh Wheat Improvement Project (1994-1995) and the Lao Upland Agriculture Development Project (LUADP) (1990-1996). The Bangladesh Wheat Improvement Project was subsequently deleted from the evaluation when floods prevented the evaluation team travelling in-country.

All evaluated projects had a substantial focus on rice production. The Cambodia and Vietnam projects were research oriented and managed by the International Rice Research Institute. The Lao project was one of parallel financing of rural development with the World Bank. Australia's contribution was managed by an Australian contractor. All projects contained elements of institutional strengthening and included capacity building and training components. The sustainability and development impacts of the projects were assessed within the overall development and policy context in which they were designed and implemented. Detailed consideration is given to environmental issues, but within a wider evaluation context which considers social, economic, technical, financial and institutional factors as well as broader policy issues and the key factors governing project success and sustainability.

The following findings are summarised within the scope of the evaluation as required in its terms of reference.

The Projects

Cambodia-IRRI-Australia Project

Effectiveness. The Cambodia-IRRI-Australia Project (CIAP) has achieved its stated objectives in Phases I-III for increasing rice production and productivity of rice-based farming systems through research, training and institutional development. It is the major source of rice research and improved rice varieties in Cambodia. Its rice breeding program has released 24 varieties since 1989. Its training programs have reached a high proportion of agricultural staff in Phnom Penh and have been experienced by about half the government agricultural staff in the provinces. CIAP publications, including monthly technotes, monthly bulletins, booklets, books and video tapes are reaching a wide audience.

Environmental Impacts. There were no environmental impacts predicted in the design of CIAP but the project has operated under environmentally responsible management and technical assistance. The project has technically sound and environmentally responsible recommendations for varietal selection, integrated nutrient management,

integrated pest management and water management. The development by CIAP of a Cambodian Soil Classification system has been important to the proper use of fertilisers. Fertiliser recommendations are soil and cropping system specific. CIAP is strongly committed to maintaining or reducing the use of pesticides in Cambodia. The proliferation of fish in the rice ecosystem is described by the Department of Fisheries as an indication that the farming technology is not having a negative environmental impact. In the Provinces east of Phnom Penh, where CIAP technologies have wide exposure, fish in the rice fields is proving to be a successful component of the farming system. There are either neutral or positive impacts reported where CIAP farming systems technology is being adopted.

Socio-economic and Institutional Impacts. The CIAP socio-economic and ecosystem studies have proved beneficial to understanding farmer needs. Farmer awareness of improved varieties appears widespread throughout Cambodia although the project design did not extend to direct interaction at the community level. The project has benefited from its strong relationships with NGOs for extension of its technological developments.

Food Security. In Phase III rice production increased by more than 1,200,000 t/year. Cambodia's total rice production has exceeded consumption needs (though geographical distribution of surpluses and deficits is uneven). More than 500,000 t/year of the increased production has come from varieties introduced by CIAP. Some part of the remaining increase is attributable to CIAP activities in research and training in rice production and farm management practices.

Sustainability. A solid foundation is being laid by CIAP for sustainability of project outputs through the training and experience given to Cambodian research scientists. The establishment of a national agricultural research institute is mooted and the CIAP scientists would be well placed to take a leading role in its research activities. The establishment of a professional agricultural society and professional research journal has given Cambodian scientists a forum to have their research results recognised. There is a question over research management skills and these need to be developed to ensure the sustainability of the research program after technical assistance is withdrawn.

Vietnam-IRRI

Effectiveness. The evaluation concluded that the Vietnam-IRRI Project was effective in achieving its objective of strengthening a research capacity, largely through training. However it was difficult to identify research funded by AusAID within the overall IRRI program.

Environmental Impacts. AusAID assistance through the Vietnam-IRRI Project has strengthened the capacity of Vietnamese agricultural scientists in a number of institutions to address a range of environmental problems. The Vietnam-IRRI rice breeding

program has developed a number of brown plant hopper resistant varieties which have been widely grown in Vietnam. Research scientists recommend integrated pest management but the use of pesticides is firmly established in the intensive agriculture systems and there are difficulties with the adoption of a reduced pesticide strategy, compounded by low prices for pesticides and easy access to them. High rates of fertilisers are used and eutrophication of waterways is suspected in some parts of the Mekong Delta. Research into acid sulphate soil reclamation was identified as an AusAID funded activity. This has led to a raised awareness of the consequences of farming these soils.

Socio-economic and Institutional Impacts. Participating institutions have worked directly and through extension services with farmer groups. Progressive farmers have been able to capitalise on this technology most effectively. From discussions with officials, it appears that more women farmers in the north have been involved in the training than in the south.

Training of Vietnamese scientists has included non degree and on the job training. It appears that between 30%-50% of trainees were women, a number of whom are now in senior positions.

Food Security. Varietal yields have doubled that of traditional varieties, reaching 6 t/ha with up to three crops per year compared to one crop per year of the traditional varieties. This has contributed to food security in Vietnam although there are regional differences. Adoption of IRRI varieties or IRRI derived varieties (estimated at 70%-80%) is widespread in the lowlands and more pronounced in the irrigated areas.

Sustainability. AusAID funding has contributed to training of rice scientists from a number of institutions including Can Tho University, the Vietnam Agricultural Science Institute and the Soils and Fertiliser Institute. Many of the scientists who were recipients of the training are continuing in rice research and training future rice scientists.

Lao Upland Agriculture Development Project

Effectiveness. Despite some shortcomings, many aspects of the Australian Technical Assistance for the LUADP have been effective. Community development and the formation of village activity groups have had positive and sustainable impacts. Household incomes have increased in the target areas and alternatives to shifting cultivation have been taken up by many households. On farm trials of improved varieties have served to demonstrate the quality and production advantages of various cash crops. However the original scope of the World Bank Staff Appraisal Report was ambitious and required reduction of targets during implementation. The effectiveness of AusAID technical assistance was compromised to some extent because roles were not clearly defined in terms of the larger World Bank Project. This led to misunderstandings over the design and supervision of infrastructure construction.

Environmental Impacts. In Laos, improved cash crop opportunities, together with improvement of roads which provide access to markets, have also attracted many shifting cultivators to settle and produce cash crops. These outcomes are contributing to the wider campaign to reduce slash and burn agriculture. Technologies associated with fruit tree production, training of farmers, provision of seedlings, and extension support are offering alternatives to slash and burn agriculture in the uplands.

There was little use of either pesticides or fertilisers in LUADP. Higher yields did provide some incentive for farmers to use both fertilisers and pesticides on improved varieties planted as a result of the availability of irrigation for dry season cropping of rice and annual cash crops. There is a risk that chemicals will be misused as affordability changes.

The irrigation system was well constructed and there were no signs of erosion of the canals or in the area of the weirs. The irrigation systems do take most, if not all, dry season flow. This is said to have no effect downstream as streams are small tributaries at the lower end of the catchment.

There was a question as to the effect of the weirs on fish population and the migration of fish. While the concrete weirs do not provide the same degree of permeability to fish as the brush weirs that they replaced, discussions with farmers suggest that the fish population has only been marginally affected by the weir construction.

Socio-economic and Institutional Impacts. The project gained official recognition of a community development approach for service delivery. It was successful in establishing a number of community groups involving men and women based on interest in production activities such as poultry raising, agriculture, and weaving. An elected member of each group was trained in the relevant skills. The project had mechanisms to ensure that these skills were transferred to other members of the group.

Villagers remarked on the increased value of their cash crops and other income generating activities. Some families downstream did not benefit from irrigation in the dry season. Nevertheless, they said that they had benefited from the training and new and improved varieties provided by the project. Water User Associations were formed and trained, although the irrigation systems were not fully operational at the time the technical assistance was withdrawn. Women were only marginally involved in these groups. While these groups appear to be generally functioning well, there are accounts of occasional conflicts between upstream and downstream farmers. There are, however, mechanisms in place for conflict resolution.

Food Security. The project has enabled the production of surplus crops for sale, thus contributing to poverty alleviation and, consequently, improved security for the target beneficiaries. The surpluses also contribute to improved food security for the nation.

Rice banks have contributed to food security and were considered by villagers to be one of the most important of the project activities. In the Kasi district, villagers trained by

the project gave priority to poorer villagers borrowing from the rice bank. Food security was also assisted by the production of a greater variety of crops which increased the range of food in villagers' diets. Cash income earned from activities such as poultry raising and weaving also enabled villagers to improve their food security.

Sustainability. The farmers are required to operate, manage and maintain the irrigation system themselves. This has been achieved by the formation of Water Users Groups The groups seem well organised and collect annual fees to provide for routine maintenance of the system and to pay the salary of one or two gate operators.

The irrigation systems are gravity fed from concrete weirs and as such, should not require extensive repairs or maintenance costs and should, therefore, be effectively managed and funded by the Water User Groups. In the event of a major flood or damage to the system, the farmers may need the assistance of the Provincial Government.

Some of the income generating activities established by the project appear sustainable with good management and established regulations. Sustainability is related to leadership skills, the establishment of market links, and the availability of credit. Difficulty in obtaining quality seed is hindering some cash crop activities.

The Hin Heup Research and Extension Training Centre, in Vientiane Province, has received 80% of its funding from project funds and 20% from provincial budget to date. Up to 1996, it was also supported by AusAID funded TA. With completion of the project, on farm trial work and training activities have diminished. Without additional provincial funds, the Hin Heup Centre may fall into disuse. The evaluation team was told that the Ban Itou Centre in the south is receiving increased funding from the Champassak Province, as well as assistance from other donors.

Lessons Learned

The following lessons were derived from conclusions made by the evaluation team after all countries were visited.

The Policy Environment.

AusAID must ensure that all relevant policy statements and guidelines are provided to partner agencies such as the World Bank for all activities which are co-financed by AusAID.

While IRRI's programs are largely positive in their environmental impact, AusAID needs to ensure that IRRI's environmental policies will allow AusAID to meet its obligations under Australian legislation. If not, AusAID needs to negotiate a Memorandum of Understanding to cover its funding agreements.

Project design should include a requirement for AusAID to provide policy information to project participants on the environment, gender and disadvantaged groups, and a mechanism for monitoring compliance with those policies during implementation.

Monitoring Impacts.

Monitoring environmental impact from agriculture is not a high priority in the cluster countries. If AusAID requires impact assessment based on quantitative data, it must be prepared to fully staff and fund the activity and use its own resources to ensure its managing agents and partners comply. Even with such support the activities may not be continued after the withdrawal of assistance.

Agricultural Technology.

When new agricultural technologies are introduced there should be an awareness of impacts beyond the scope and duration of the project. There needs to be a preparedness to monitor impacts and research new and unforseen issues arising so that corrective measures can be taken before the impacts become excessive.

Resource use.

Increasing population, poverty and lack of income earning opportunities are leading to greater pressure on wild resources to supplement farm incomes and for food. Projects need to offer a range of options of alternative income earning opportunities which are available to all ages.

Design and Management.

Project design targets need to be realistic in terms of expected outputs and duration with due consideration given to the implementation capacity of the beneficiaries.

There can be considerable value adding to AusAID's project outcomes through partnerships with CGIAR centres.

When Australian funds are managed by institutions such as IRRI, it must be realised that their design and management procedures may not conform to AusAID requirements. If AusAID requires compliance to its operations guidelines, they must be specified in the funding agreement and may require additional funding to provide the institution with the resources and/or training to comply.

In parallel financing projects with the World Bank, AusAID must ensure there is clarification of roles and responsibilities between all parties, within an agreed project framework.

The failure of the partner country to meet its commitment in providing suitable counterparts, facilities and budget, can compromise achievement of project effectiveness.

Intellectual Property.

The management of incumbent IP and that arising from the project and access to biotechnology plus its responsible deployment must be considered in the design of

agricultural research projects particularly those concerned with plant/animal breeding and protection.

Use of Research Data.

The capture of the data generated in research programs for later exploitation or for concurrent analysis in other regions, should be considered at the project design phase.

Cost Effectiveness of Training.

Training in research, and strengthening research extension linkages on a nation wide basis, can be cost effective. Strengthening extension-community linkages, and training communities in a small area, with consultant advisers fully funded by Australia is relatively expensive. Training of communities can be effective, but may be better implemented through NGOs. This has been particularly effective in Cambodia.

Research Extension Linkages.

Project designs must explain how the research extension linkages will ensure research results are available for farmer adoption. This does not imply that projects must include both research and extension but rather identify what the constraints may be to having research results adopted. This may highlight the need for separate assistance to extension services.

Participatory processes required by a farmer driven extension approach offer excellent opportunities to apply gender and environmental guidelines. However it takes time to develop a level of expertise which can ensure sustainability. AusAID needs to be aware of the time requirement and consider funding and duration to suit the technical and social realities of the activity.

The project design must consider how technology transfer will occur. This may include linkage with the private sector for seed multiplication and distribution.

Gender awareness.

All project participants need to be aware of gender issues and how to apply these in their work. Gender awareness should be extended to implementing agencies as well as to project staff. The continuing presence of a gender adviser can maintain the consistency of project attention to gender issues.

Women as Decision Makers.

Projects need to develop strategies to promote women's membership of formal decision making organisations. Membership rules and regulations need to be examined and, if necessary, altered to enable more women to be involved. Existing members need to be consulted and encouraged to develop their own strategies to invite and encourage women to join. Women themselves need to know that their involvement is important.

In order to obtain a greater proportion of qualified professional women in important decision making bodies related to agricultural development, more effort needs to be made to encourage women to enter agricultural education.

Sustainability.

There are certain procedures in agricultural development which necessitate a long term commitment to achieve objectives. If AusAID is willing to start the process it must either commit for the full term or ensure its inputs can be sustained to see the term completed. Funding training activities will allow AusAID to contribute to agricultural development. Without long term commitment, however, AusAID cannot expect to have such contribution recognised against other donors with longer commitment.

1. INTRODUCTION

For this Environment Cluster Evaluation, three food production projects were selected. The projects were:

- Phases I-III of the Cambodia-IRRI-Australia Project (CIAP)
- Vietnam-IRRI Project (managed by IRRI)
- Lao Upland Agriculture Development Project (LUADP – parallel financed with the World Bank)
- Bangladesh Wheat Improvement Project (BAWIP – managed by CIMMYT).

Although originally selected, BAWIP was excluded from the evaluation when floods devastated the country. With the exception of CIAP, all projects were completed. In the case of CIAP, the evaluation covered the first three phases of the project, the last of which was completed in June 1996.

The projects eventually included in the evaluation were focused on rice production and on strategies to improve food security. The two projects which were undertaken in collaboration with IRRI were research oriented. They also had significant scientific training components. The Lao project was aimed more directly at farmers and involved Technical Assistance for research into improved varieties, community development and infrastructure development. Institution strengthening was an important aspect of all three projects.

1.1. Environment Cluster Evaluation Procedures

The evaluation is part of AusAID's mainstreaming approach to environmental review. The *Environment Audit of the Australian Overseas Aid Program* (AusAID 1994) recommended that representative samples of AusAID funded activities should be periodically evaluated from an environmental perspective.

AusAID decided to conduct an environment systems audit every third year, with ex-post cluster evaluations of the environmental aspects of projects undertaken in the intervening years. A cluster evaluation covers a group of projects from one sector, allowing common themes and issues to be highlighted and lessons drawn. Cluster evaluations allow for small projects to be included. Ex-post evaluation of individual small projects is rarely cost effective. A cluster of energy-related projects was completed in 1997. This is the second environment cluster evaluation.

1.2. Objectives and Methods

The evaluation was undertaken over a 7 week period between August and October 1998. Briefings from AusAID staff, planning for the field work and a literature review of project documents were completed in Canberra between 3-11 August 1998. From the results of

the literature review, an Issues Paper was written. Fieldwork was conducted in Cambodia from 30 August-5 September; in Vietnam from 6-12 September and Lao PDR from 14-24 September 1998. The fieldwork involved interviews with AusAID posts, project staff (where they were still in the country and available), participating institutions, recipient government officials, NGOs, staff from other relevant projects and individual and group discussions with men and women farmers involved with the projects.

A shortened draft of the evaluation was cleared with partner governments through Aides Memoire. The evaluation report was then finalised in Australia. The partner governments will receive copies of the final report. As well as being available in hard copy, the final report will be published on AusAID's website.

The team consisted of Mr Grahame Hunter, team leader and agriculturalist; Mr Jim Elston, economist; Ms Gaynor Dawson, sociologist; Dr Paul Brennan, plant breeder; Mr Neil Mayo, engineer. Ms Irene Wettenhall from AusAID, Canberra, accompanied the team in Cambodia and Vietnam. Ms Carolyn Brennan from AusAID, Canberra, accompanied the team in Laos.

2. Cambodia-IRRI-Australia Project

2.1. Background to the Project

After years of war and turmoil, Cambodian agriculture has been dominated by a mission to produce food to feed the people and this quest has centred on the rice crop as the nation's staple food. The threat of famine has been so real that, rightly or wrongly, environmental impacts of food production have not been considered until quite recently. This was the political environment in which the Government of Cambodia requested assistance from IRRI which AusAID was willing to fund.

2.1.1. Development Context

Agriculture in Cambodia produces about 45% of gross domestic product (GDP) and employs around 80% of the population. The sector is almost totally dependent on international support and non-government organisations (NGOs) have played a major role in its development over the last 15 years. The first *Cambodian State of Environment Report* (Ministry of Environment 1994), was prepared by the Ministry of Environment in association with UNDP and other donors.

Lowland rain fed rice is the dominant rice production system. It is susceptible to rainfall variations, requires photoperiod sensitive varieties, utilises minimum inputs and produces low yields (1.3 t/ha; Helmers 997). Soil fertility is an inherent problem and some of the land has been farmed for hundreds of years (Helmers 1997). Clearing for agriculture and aquaculture has encroached on the wetlands around the Mekong River and Tonle Sap Lake systems (Helmers 1997). To date Cambodia's rice farmers use relatively less

pesticide than neighbouring countries and the natural enemies in the fields are more diverse and in greater numbers compared with other countries in the region (Jahn *et al* 1996). Over 9% of plant species in Cambodia's forests are endemic and 66 habitats, areas and sites have been identified as critical and fragile (Helmers 1997). Most of these are on the forested lands and stabilising agriculture to prevent more clearing will help prevent further destruction.

Food insecurity is a big issue for rural households and it is only in the last three years that the national rice balance has been restored. There are 2.6 million ha of paddy field of which about 75% is planted each year (Hunter *et al* 1998). Over the past few years land tenure and titling have become the focus of much attention due to titling and land disputes in areas of rapid development.

Post-war demands on households for food security and the satisfaction of basic survival needs have created contradictions between traditional gender roles and new behaviour patterns. Due to shortages of male labour, many women have taken on tasks previously performed by men (Hunter *et al* 1998).

2.1.2. Description of the Project

The project is AusAID funded and IRRI managed. It is currently in its fourth phase, with Phase I commencing in March 1987 (AUD 374,000), Phase II in January 1989 (USD 2.31 million ~AUD 2.987 million), Phase III in July 1991 (AUD 11.0 million) and Phase IV in January 1997 (AUD 11.15 million) (Hunter et al 1998). Institutionally the project is located in the Ministry of Agriculture, Forestry and Fisheries, Department of Agronomy. Staff are seconded to the project and salary supplements paid. Training is provided. Equipment and materials are procured to facilitate research (Hunter et al 1998).

A consistent theme of all phases, as reflected in their goals, has been to increase rice production in Cambodian farming systems and to develop a rice research capacity in Cambodia. Each phase has been a natural progression from that preceding, based on recommendations arising from AusAID reviews. By Phase III the project scope covered research across most facets of the rice based farming system, including varietal improvement, integrated nutrient management (INM), integrated pest management (IPM), farm mechanisation and socio-economics (Hunter et al 1998). The project was designed to achieve its goal to increase rice production and productivity by:

a) improving the technical expertise of scientists and technicians in research, training and extension;

b) strengthening the quality and increasing the quantity of rice research in Cambodia;

c) accelerating the transfer of improved technology to rice farmers; and

d) assisting in the development of research and training infrastructures.

The project was reviewed by AusAID in December 1990 and again in April 1995 (Bennett and Hunter 1995). Phase III was implemented in accordance with a Project Implementation Document (PID) approved by AusAID in 1991, addressing the recommendations of the 1990 review. Each review found the project progressing towards its stated objectives, meeting early demands for release of higher yielding varieties for increased rice production. Phases I to III constitute the focus of the evaluation.

2.2. Environmental Assessment

The project was designed without deliberate attention to environmental guidelines but has operated under environmentally responsible management and technical assistance. The combination of varietal improvement, INM, IPM and water management has led to technologies that are sustainable within a rice based ecosystem.[1] However when the technology is misinterpreted, there can be negative environmental consequences. For example, farmer perceptions were that improved varieties are often associated with requirements for agricultural chemicals. Although not recommended by the project, there are reports of inappropriate use of pesticides and possibly fertilisers, especially in the dry season crop.[2]

2.2.1. Policy Guidelines

AusAID's environmental guidelines were unknown to the project until recently. No guidance was provided by IRRI for addressing environmental issues. The first *Cambodian State of Environment Report* (Ministry of Environment 1994) emphasises wise management of natural resources to feed the nation and to produce surplus for export. CIAP contributes directly to this objective. Policies at the national level are urgently required for economic and natural resource accounting, land use and resource management, with supporting legislation for regulation and funding for impact monitoring.

1 Personal communication Nesbitt

2 Personal communication CIAP, FAO IPM Program, CAAEP

2.2.2. Environmental Impacts

ENVIRONMENTAL ASSESSMENT

(Using AusAID Screening Guidelines – 1989)

1. Soil and land management is a significant issue. Research is targeted at a balanced approach to nutrient management, leading to a reduction in waste. Inorganic fertiliser recommendations are low and soil management recommendations are leading to rehabilitation of degraded soils after centuries of rice monoculture.
2. Water management is a significant issue. Varietal selection, land remodelling and crop diversification result in better water management. The project does not draw on ground water resources. The IPM strategy protects the water resources from effluent.
3. Biological management is a significant issue. The project has contributed to the restoration of Cambodia's rice genetic resources from seed previously collected by IRRI and preserved in its Los Baños genebank. Rice-fish technologies will enhance the habitats for aquatic wild plants and animals.
4. Air quality and noise is not a significant issue.
5. Waste management is not a significant issue.
6. CIAP is very aware of the risks and hazard from pesticide abuse. It is developing and advocating management strategies to minimise the significance of this issue.
7. Social issues are significant. The population is living in poverty in a traditional lifestyle. Crop diversification and fish in the rice field improves income and diet. Improvements in household food security will relieve the pressure on wild food harvests.
8. Environmental issues in the economic analysis are not significant.

Cambodian people would probably be prepared to accept negative environmental impacts for short term gains in food security. There is little or no data on environmental impacts of agricultural technology in Cambodia. The evaluation team applied the AusAID screening guidelines of 1989 (AusAID 1989) and concluded that the project had a neutral to positive effect on the environment (see box).

The loss of biodiversity, land degradation, misuse of pesticides, destruction of wetlands and mismanagement of water resources are often discussed in the context of agricultural development. CIAP technologies did not contribute to any of these events. In fact, without CIAP substantially greater pesticide misuse may have occurred.

Land. Land degradation is not a problem in the lowland rice areas that are flat and inundated with flood waters loaded with silt each year. CIAP recommendations aim to increase productivity by improving the production system rather than expanding areas. They focus on the development of an effective rice production system that is sustainable and has a minimal deleterious effect on the environment. The development of a

Cambodian soil classification system has been extremely important to the proper use of fertilisers, allowing fertiliser recommendations to be soil and crop specific, therefore reducing waste (White *et al* 1997).

Water. Land levelling technology for rice paddies has a significant benefit in that it allows the retention of substantially more water on farm thus reducing flood and the consequent loss of productivity and damage to private and public utilities (Rickman *et al* 1995; Rickman and Cox 1998).

Saline water quality problems are apparently developing in the irrigation system at Kampong Ro, Svay Rieng province. This is not a CIAP activity although advice from CIAP engineers, if heeded, may have prevented this situation from developing.[3]

Biodiversity. Wild plants and animals in the rice ecosystem constitute an important part of the food for farm families. CIAP has undertaken a large number of studies on biodiversity and has found there are either neutral or positive impacts where CIAP farming systems technology is being adopted. (Jahn *et al* 1996). The surveys to collect such data have been time consuming and costly. The proliferation of fish in the rice ecosystem is described by the Department of Fisheries[4] as an indicator of positive environmental impacts.

The more stable and viable the farming system and the less risk farmers are exposed to, reduces the likelihood that, when times are difficult, they will look for other income earning opportunities. Some of these may be environmentally damaging (for instance, cutting wood to sell for firewood or over-collection of wild foods). Villagers interviewed in Svay Rieng Province had noted changes in their ecosystem including a reduction in the numbers of animals and plants. They attributed these changes to increasing population pressure, changing rainfall patterns, and deforestation during the Pol Pot era rather than any effect of the use of CIAP technology. The animals and plants now in declining numbers are also those collected by farmers for their own consumption or for the market.

Pesticides. There is relatively little use of pesticides in Cambodia's rice fields and the natural enemies in the fields are more diverse and in greater numbers compared with other countries in the region (Jahn *et al* 1996). To preserve these populations, careful management and judicious use of pesticides is essential. High levels of pesticides are used for rice production in neighbouring countries where they are having a deleterious effect on health (Kritalugsana 1988). This level of pesticide abuse and the consequent environmental and social impact could also occur in Cambodia. CIAP breeding and IPM groups are heavily involved in developing technologies to prevent this abuse in Cambodia.

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3 Manager, Kompong Ro irrigation scheme

4 Personal communication.

According to the project's baseline survey report on pest management in lowland rice (Jahn *et al* 1996), pesticide use was higher in the dry season when farmers planted the modern, early maturing varieties and was positively associated with IRRI varieties. In the dry season, 59% of farmers used pesticides compared with about 27% in the wet season. Farmers who were not trained in IPM did not have a good understanding of the nature of pesticides or of their correct use. Most information was gained from neighbours or relatives.

The project cooperated with the national IPM program managed by FAO (FAO 1998). Men and women farmers interviewed, who had taken part in IPM farmer field schools, were aware of the need to use minimal amounts of pesticide, of the necessity to reduce spray drift, and that pesticides killed pests and their natural enemies.

CIAP has been instrumental in assisting the development of draft legislation to regulate agricultural chemicals and, in addition, providing technical input to assist with a second draft. In August 1998 the Ministry of Agriculture, Forestry and Fisheries submitted a draft decree for pesticide use. If passed, it will be a positive step toward control of pesticide use in Cambodia. There is a clear need for strong government leadership in regulating the sale of pesticides in the country. It is important that a register of safe chemicals be itemised by government and sales restricted to those listed on the register with provisions for prosecution of vendors of unregistered chemicals.

2.3. Implementation Assessment

The project has made significant progress in the development of Cambodia's research capacity and contributed to the rice production and productivity of the nation. In Phase III of the project, rice production increased by more than 1,200,000 t/year (more than 30%). For the last three years, Cambodia's total rice production has exceeded consumption needs although there are geographical differences in surpluses and deficits. More than 500,000 t/year of the increased production has come from varieties released by CIAP (CIAP 1998). A significant part of the remaining increase is attributable to other CIAP activities in research and training in rice production and farm management practices.

2.3.1. Implementation Achievements

The project achieved its stated objectives for Phases I-III for increasing rice production and productivity of rice-based farming systems through research, training and institutional development.

2.3.2. Technical Impact

Conservation and collection of Cambodian rice varieties resulted in 95% of native varieties collected across 17 provinces. Two thousand varieties were introduced and

tested and a hybridisation and selection program commenced (see Box; CIAP Annual Reports 1996 and 1997).

Achievements of CIAP 1989-1996

- Release of 24 improved rice varieties. Yield advantage of improved varieties is consistently 10-15% higher than traditional varieties.
- More efficient use of inorganic fertilisers. Yield increments of 20-30% across most soil types for both improved and traditional varieties.
- Development of a new approach for identifying and classification of Cambodian soils for optimal application of inorganic fertilisers.
- Research and development of IPM to prevent pesticide abuse and to enhance productivity.
- Demonstration of crop diversification in a rice based farming system.
- Demonstration of the value of land levelling and on-farm water conservation techniques.
- Conducted quantitative socio-economic surveys which have contributed to the understanding of Cambodian rice farming households.
- Furthered the professional development of women agricultural scientists and technicians.
- Formal and informal training in country and abroad.
- Research infrastructure development across 11 provinces.

Twenty four varieties have been released since 1989. Several of these (the IRRI varieties) now occupy the majority of the area planted to rice in the dry season. This is due to their high yield in this ecosystem and good eating quality (Javier 1996). CIAP released varieties have, so far, failed to make an impact in the wet season. This highlights the considerable environmental difference between this ecosystem in Cambodia and most other rice growing ecosystems. CIAP concluded that significant advances in productivity would only be made through a breeding program that specifically targets the Cambodian wet season. The slow adoption of CIAP varieties is partially due to the lack of an effective national seed multiplication and distribution scheme.

The breeding problems currently facing CIAP, such as the brown plant hopper, will require more sophisticated solutions that may include biotechnology. Much of this technology has been developed in the private sector who will require a financial return for its use. There is currently not sufficient appreciation in CIAP of the biotechnology options available or consideration of how these may be safely deployed. Intellectual property (IP) resulting from the varieties developed, may provide a revenue stream that can be used to gain access to the required biotechnology. Again, there is insufficient appreciation of IP considerations which are, currently, a major issue for plant breeding.

Many hundreds of experiments are carried out in the course of a large agricultural research project. The data generated has value that transcends the immediate application and region. This is the situation with CIAP but, as yet, there is no provision for electronic data storage or access by other scientists. International database systems are available through IRRI which would guarantee long term data storage, provide access to CIAP data by other agencies, and allow CIAP access to data generated elsewhere.

The release of a manual (White et al 1997) for the identification of soils in Cambodia takes a new approach so that people without formal training in soil science can identify their soils. This facilitates the technical recommendations of other project components which are linked to soil type. Recommendations for green manuring, organic and inorganic fertilisers are available across all soil types. However, the adoption rate has been low due to lack of seed and the immediate need to produce food. CIAP research has shown that all the rice soils respond to nitrogen, phosphorus and potassium (CIAP 1996). This is significant for farmers using fertiliser who tend to use a single nutrient (urea) or at best a nitrogen phosphorus mix (DAP). On some soils, they would get little or no response for their input. Research has shown that a Sesbania green manure crop can provide a 24% yield increment in the following rice crop. However a lack of seed has resulted in few farmers adopting the technology.

Much of the early farming systems research revolved around crop diversification. Increasing cropping system diversity in rain fed areas is constrained by seasonal flooding. Where dry season irrigation is available, mung beans yield 0.6-1.0 t/ha and the following rice crop yields 4-5 t/ha compared to a control of 3 t/ha (Bennett and Hunter 1995). Land remodelling in the form of a ditch and dyke increases the potential for crop diversity. The project is continuing to collect data on the value of the ditch and dyke system. Fish in the rice field has become a new development within farming systems research. This may prove to be beneficial to the rice crop, farm family nutrition, farm income, water management, and the maintenance of aquatic habitats and biodiversity in the rice ecosystems.

The baseline study conducted by the Agricultural Engineering group suggested that major productivity gains would be achieved through land levelling in paddy fields (Rickman and Cox 1998). The advantages included even depth of water across the paddy field and improved water harvesting. Land levelling would enhance the utility of direct seeding which would eliminate the need for transplanting.

The baseline study (Jahn *et al* 1996) conducted by the IPM group has identified that pesticide usage in Cambodia is substantially lower than that of its international neighbours who are experiencing health (Kritalugsana 1988) and environment problems due to pesticides used in rice. The main pests are the brown plant hopper, gall midge, stem borer and rice bug.

2.3.3. Economic Impact

Economic evaluation of the project was not attempted during project preparation, and has not yet been undertaken by the project. However, some indication of benefits can be deduced from available data, leading to a conclusion that the economic impact, from the national viewpoint, has been positive.

From 1992 to 1996, the area of rice production increased from 1.85 million to 2.1 million hectares, and production increased from 2.2 million tonnes to 3.4 million tonnes per year.[5] Of the total production now being achieved, it is estimated that more than 0.5 million tonnes are derived from varieties introduced, trialed and promoted by CIAP. Very substantial contributions have, and are being made, by other CIAP projects. This has been largely achieved through effective collaboration with existing extension activities, notably NGOs and other agencies operating in Cambodia.

Without the project, it is expected that the rice area would have increased anyway, but lesser yielding varieties would have been used. The CIAP varieties so far, compared to the likely situation without the project, have probably added about 100,000 tonnes per year to total production. The project has increased total rice production through increased productivity, thus meeting the project goal.

There is probably little difference in total fertiliser and chemical use with or without the project, but more efficient application of fertiliser is practised where CIAP has impacted, while use of chemical pesticide may be less with CIAP approaches to pest management. Similarly, labour use at present is probably little different with or without the project. Research now being undertaken by the project could reduce labour use in the future.

It is considered that the work to the end of Phase III has gained a momentum of its own sufficient to sustain the extent of annual net benefit achieved to the end of Phase III. Crude estimates of economic cash flows suggest that from the national point of view, the economic internal rate of return (EIRR) is probably greater than 50%.

Most of the benefits to the end of Phase III have been from dry season productivity of rice. Research now being undertaken by CIAP offers potential in the future for improved productivity of wet season rice, and increased production from other crops in rice based farming systems. By employing the same approach as in the past, using intensive training, and collaboration with existing agencies for trial work, demonstration and on-farm extension, the economic impact of the project since Phase III could also be significant.

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5 Personal communication Dept Planning and Statistics, Ministry of Agriculture, Forestry and Fisheries

2.3.4. Institutional Impact

CIAP has had a significant impact on human resources development in Cambodia for persons working in agricultural research and related disciplines. It is also making a significant contribution towards establishing a Cambodian Agricultural Research and Development Institute (CARDI) to continue the development of sustainable technologies for rice-based farming systems in Cambodia.

To the end of Phase III, the project sponsored 2,310 placements at CIAP in-country training courses; 1,772 participants at in-country workshops and conferences; 196 participants in short term training abroad, and 63 to study tours and conferences abroad. Postgraduate study opportunity abroad has been provided for 10 PhD candidates and 3 Master degree candidates. In addition, 7 research scholarships have been provided for researcher workers in Cambodia. Most of the students, who obtained degrees through this project, continue to work in rice research in Cambodia, principally in CIAP.

These activities are significant in enhancing Cambodia's capacity to sustain a technology development program. Another very significant impact of the project has been the leadership of CIAP in developing the Cambodian Society of Agriculture and the publication of the Society's scientific journal.

2.3.5. Social and Cultural Impact

Technology transfer. Mechanisms for extending research results directly to farmers were not part of project design. CIAP had limited direct interaction with the community and relied largely on NGOs. The NGOs are enthusiastic about CIAP and told the evaluation team that it provided them with beneficial technical information to enable them to conduct training at village level. The information flow was not one way. CIAP also obtained feed-back about project impact at the village level and constraints to adoption of its technology.

CIAP conducted numerous on-farm trials on cooperating farmers' fields throughout the country for demonstration and research purposes. Focus group discussions with women and men farmers in Svay Rieng Province revealed that the direct transfer of technology from these trials to the surrounding community was restricted. Farmers often wanted to try the new varieties after seeing them in the on-farm trials but there were difficulties obtaining seed and technical information.

Technical material was provided by CIAP, including many publications translated into Khmer. CIAP was highly dependent on the capability of other organisations, predominantly NGOs, to interpret technical recommendations and restate them accurately in a form applicable to local conditions and in a form farmers could understand. CIAP was not able to monitor this process systematically but was aware of the existence of some confusion in interpretation of recommendations.

Because of the need for technology transfer to farmers to be through other organisations, it has been their agendas and policies which have determined the approaches which were taken and not those of AusAID. The NGOs and other extension agents interviewed for this evaluation were responsible, with forward-looking participatory and gender-sensitive approaches. Nevertheless, AusAID needs to consider carefully the implications for project design and funding, of agricultural research which relies for its application on ad hoc relationships with various organisations which do not operate within the framework of AusAID guidelines.

Technology adoption issues. The farmers interviewed in Svay Rieng appreciated the range of rice varieties being made available by CIAP. They said that these extended the cultivation period enabling them to spread risks and peak labour demands, and gave them a more continuous food supply. Through its farming systems section, the project was also experimenting with diversifying on-farm food and income sources, such as introducing fish in the rice fields and the growing of legumes. If adopted, these practices would also spread farmer risk.

The most widely adopted improved rice variety was IR 66, a dry season rice limited to irrigated areas (Jahn *et al* 1996). Early, medium and late wet season varieties were also introduced but have been less widely accepted by farmers in rain fed areas. In the village that relied on rain fed rice in Svay Rieng province, the main constraints expressed by villagers to adoption of CIAP technology were lack of water supplies, higher risk of pest damage, lack of access to project recommended machinery for land levelling and improved water management, labour shortages and costs, and difficulty in obtaining seed and information. The latter was compounded by poor storage techniques and seed contamination with other varieties after the second generation of commercial cultivation.

Interviews with several NGOs suggested that CIAP recommendations were directed at the requirements of Cambodian farmers. However, advice from the Department of Agronomy suggests there were difficulties in applying the CIAP recommendations. This may be due to lack of capital. Some NGOs expressed concern at the risk of indebtedness for poor households and reported that they had provided small credit packages to enable farmers to borrow from them, rather than from money lenders.

CIAP addresses the eating quality of rice in its breeding program. A major component of this is the hardness of the grain. The CIAP varieties tend to range in hardness from soft to medium. Farmers producing at, or below subsistence level, choose to consume hard grained varieties that give a longer feeling of fullness after a meal than softer varieties. Less rice is required to feed a family if the variety is hard. CIAP argues that they prefer to address this hunger problem through productivity increases. It appeared that poor farmers were not systematically included in taste and aroma testing. Some testing was conducted by CIAP with the cooperating farmers. Other testing was conducted at meetings of non-farmers.

A number of baseline socio-economic studies (Lando and Mak 1991; Lando and Mak 1994; Rickman *et al* 1995 and Jahn et al 1996) were conducted which have made valuable contributions to the understanding of the Cambodian rice-farming household and are expected to provide a benchmark for evaluation of impact in the future. The baseline surveys used questionnaire quantitative data collection methods. A more participatory action research approach began to evolve during the final period of Phase III and is being expanded in Phase IV.

2.3.6. Impact on Women

In 1990, a joint AusAID and IRRI review of the project recommended that socio-economic baseline studies be conducted, including an assessment of women's roles in rice-based farming systems (Paris *et al* 1992). As a result, an IRRI gender adviser provided one month's input in 1992. The principal import of the recommendations was the increase in research and training activities with women farmers and the application of particular attention to the special needs of the approximately 35% of households headed by women. This was important because, in comparison with male headed households, they had access to less non-farm income and were, therefore, more dependent on agricultural production. The project did not have knowledge of AusAID's gender policy and guidelines at the time nor the revised 1992 version. It was noted that AusAID's gender guidelines were not distributed to the project until the cluster evaluation team's visit in 1998.

CIAP have used some women as cooperating farmers in on-farm trials. For example, in the farming system study, 4 of 31 farmer participants were women and 10 of 21 households involved in the engineering groups study were headed by women.[6] When supervising on-farm trials, CIAP staff endeavoured to discuss issues and involve the wives of the male farmers. In 1995, about 4% of CIAP cooperators who were government agricultural agents from different departments, were women. The early socio-economic baseline surveys did not have women respondents. Later studies have included women, for example the Baseline Survey Report No. 6 on farmer pest management and rice production practices in lowland rice in which 43% of respondents were women (Jahn et al 1996)

The potential differential impact of introduced CIAP technology on women and men's agricultural workload was unclear. For instance, while land levelling and improved water management practices were expected to reduce the amount of time women spent on transplanting and weeding, the greater demands of harvesting higher yielding varieties may add to women's work. CIAP was aware of the need to assess these issues but they needed further analysis.

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6 Personal communication, Project Manager

In relation to the numbers of women farmers and the proportion of agricultural work that women perform, there was an overall shortage of women who were trained as agricultural professionals. In 1990, only 13% of agronomy graduates from Cham Car Daung University were women. In 1995, CIAP estimated as a rough benchmark, that 5% of the total technical staff involved in all agricultural government services were women. Gender-disaggregated data regarding the project's training and education for scientists and technicians point to CIAP's contribution to the advancement of women agricultural professionals. Between 1987 and 1995, women filled an average of 14% of in-country non-degree training places, 10% of non-degree training abroad, 14% of post-graduate training abroad, and 8% of study tours and conferences offered by CIAP. In 1995, 8% of CIAP technical staff were women. These women were employed within the agronomy and social science teams (Helmer 1995).

Members of CIAP's senior professional staff were elected to the positions of president and secretary of the newly formed Cambodian Agricultural Society. Both are Cambodian women.

2.3.7. Performance of Management

There is little doubt that the project has benefited from the technical resources of IRRI. IRRI's gene bank has been extremely important in the restoration of traditional varieties and in the varietal improvement program. Its technical resources have supported both national and expatriate CIAP scientists and IRRI experts have made regular visits to the project without any additional costs to the project. The training facilities in Los Baños have been a useful asset available to the project.

While the technical excellence of IRRI management cannot be questioned, it is apparent they have given little guidance to the project in terms of environmental issues. It would appear that the understanding was for CIAP "to be aware of environment and gender issues". It is also apparent that AusAID has never questioned this approach and the Cambodian government remains focused on food security. Therefore the environmental responsibility displayed in the project is attributable to CIAP staff.

2.3.8. Cost Effectiveness

To the end of Phase III, Australian assistance had totalled approximately AUD 14.5 million. In gross terms, about AUD 150 million (~USD 100 million) of rice output is now derived from varieties introduced, trialed, and promoted by CIAP.[7] In net terms, comparing estimated production with and without the project, the project is thought to have increased national rice output by 100,000 t/year or by about 3%. This is a remarkable achievement in a relatively short time.

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7 An estimated 500,000 t/year (see section 2.3) valued at AUD300/t (USD200/t).

Cost effectiveness has been enhanced by the high returns to using off the shelf technology (for example, the IR66 variety). Cost effectiveness has been enhanced by the widespread training of provincial agricultural staff, the effective collaboration on trials, demonstrations, and extension by many NGOs and other agencies involved in agriculture in Cambodia. About 200 on-farm trials/year are currently conducted and funded by NGOs following CIP protocols.

Broad coverage of on-farm trials, the emphasis on training, and dissemination of results and materials to trainers, extension agents and agencies directly involved with farm households, have been major aspects of CIAP design which have contributed to the well-focused application of the limited Australian aid dollar in this project. Australia's aid must be judged as very cost effective assistance.

2.4. Sustainability of Outputs

The sustainability of CIAP is dependent upon the new (relatively inexperienced) cadre of scientists who manage and lead the research program. Sustainability is also dependant upon the institutional framework (organisation and funding) which supports their management. The project has made significant achievements in developing technical expertise in Cambodia. This is now expanding into the provinces with technical and financial assistance from CIAP being available for provincial scientists. The management of the research remains in the hands of the expatriate advisers. There is a counterpart system in place to provide for sustainability in research management. However, this requires strengthening and should be addressed in the upcoming project review.

The Ministry of Agriculture, Forestry and Fisheries describes the future of agricultural research in Cambodia as dependent on external support for the Cambodian Agricultural Research and Development Institute (CARDI). This will require donor funding for its establishment and operations. The skills to report technically and financially to international funding agencies must be developed if this is to be managed by a national scientist. For CIAP itself, there is concern about the continued funding of operational costs. The actual total cost of operational funding is 28% (CIAP 1996) of the total CIAP budget but the institutionalisation of these costs into the Cambodian budget is unlikely. If the external funding stopped and the national scientists were absorbed into the Department of Agronomy, their productivity would depend upon the level of funding and leadership provided to support their research. It is possible that, without funding and leadership, they would find positions outside the Department of Agronomy, leaving a deficit in skills required to maintain the research effort.

Sustainability of Varietal Improvement

The 24 varieties released by the project are higher yielding and consistently successful in favourable conditions of water, soil and pest management. CIAP has been less successful in releasing varieties for the rain fed ecosystem. Success in this area will probably be

achieved through a national breeding program which has commenced. CIAP varieties appear to be attractive to many consumers and contribute to national rice production and the overall economy. The question is whether they are easily adopted by farmers. The availability of good quality seed and a perception that they require higher inputs than the traditional varieties, thus increasing the financial risks, are constraints to the sustainability of the output. Also, more difficult breeding problems, such as the resistance to brown plant hopper, remain to be solved.

If Australia is to continue to invest in sustainable productivity, a longer term funding commitment will be required. Plant improvement is a long cycle activity and the CIAP group are well placed to deliver the benefits from such an investment as they have:

- the required intellectual capacity
- detailed knowledge of Cambodian rice growing
- vast germplasm collection and detailed knowledge of that collection
- a considerable national and international profile which would make them an attractive investment agency for donors

Sustainability of Farming Systems Research

The rice based cropping systems studied by the project are variations of farmer practices. The extent to which the research is adopted depends on the resources (land, water, labour and capital) available to the farmer. A resource poor farmer in a rain fed environment could benefit from the adoption of INM and IPM technologies. Adoption by such farmers of INM and IPM will depend on the individual farmer's attitude to risk involving, as it does, low cash flow and unpredictable seasonal variations in rainfall. Farm budgets indicate diversification of the farming system is often a sustainable option in a rice monoculture system.

Training/Extension

CIAP staff are technically well trained and highly motivated. Their technical competence and industry is exceptional. However, the dissemination of their recommendations to the farming community for adoption is dependent on research, extension and farmer linkages which have been evolving over the term of the project. In its early years, the project relied on NGOs (local and international) as the vehicle for delivery of their extension message. The relationship CIAP has built with NGOs remains strong today and institutions such as the Cambodian Society of Agriculture ensures its sustainability. Since 1995 the Department of Extension has been the official agency for extension services.

Although CIAP relies on others to disseminate research results to the farming community, this does not remove its responsibility to formulate extension messages and ensure the distribution of extension material prepared by the project.

2.5. Lessons Learned

For the last three years, Cambodia's total rice production has exceeded consumption needs. Much of the surplus can be attributed to the CIAP project. The release of improved varieties, integrated pest management and integrated nutrient management technologies all contribute to increased rice production in an ecologically sustainable manner. The success in rice production is consistent with government policy aimed at national self sufficiency in rice production. The Cambodian Government estimates, however, that about 40% of the population is still short of food. The lesson derived from this is that food security is more complex than increasing food production. It also relates to the distribution of surplus, purchasing power of the population and the storage capacities.

CIAP would have not identified new opportunities (engineering, participatory research) and would not have fully exploited the existing project components if the project had been terminated after Phase III. The lesson here is that agricultural research is a long term learning process.

There is a lesson that research projects need a mechanism for institutionalising the transfer of technology and information to farmers. They also need a system for enabling farmers to effectively identify and communicate their own problems, preferences and priorities in a participatory manner, and for encouraging scientists to feed them into the research agenda. The project has been able to link with NGOs and, more recently, the Department of Agricultural Extension assisted by the new Cambodia-Australia Agricultural Extension Project. It is important that project designs ensure there are linkages between research and those who are expected to adopt the new technology and ensure that there is a means for a two way flow of information.

The slow uptake of CIAP varieties was, in part, due to lack of a national seed multiplication and distribution scheme. It should be realised that at the start of the project there was an urgency to identify improved varieties suitable for rice production in Cambodia. As this was achieved the multiplication and distribution of the seed became critical as to date remains an issue. This is now being addressed in new projects supported by donors including AusAID. It is a moot point whether CIAP required seed multiplication as part of its design. It certainly would have become a different project. This highlights the lesson that the design of a plant improvement program must consider mechanisms for production and delivery of quality seed to farmers.

Gender and environmental guidelines were not provided to CIAP by IRRI or AusAID. This raises an important lesson. AusAID must ensure that projects have copies of relevant guidelines, for example gender guidelines, if it requires project compliance.

The full benefits of a research project will only be fully realised through the strengthening and integration of a range of non-research activities such as low interest credit and seed schemes. The lesson learned is that the design of a research project must be considered in the context of a larger agricultural development program.

Training for scientists was a significant component of the project in Phases I-III. While comparing favourably with numbers of women technical staff in agriculture, only about 14% of in-country non-degree trainees, 10% of non-degree trainees abroad, 14% of post graduates, and 8% of people participating in study tours and conferences in this period were women. These numbers reflect the generally low proportion of women enrolled in agricultural education at universities and other institutions. The low involvement of women agricultural professionals contrasts with the number of farm households headed by women in Cambodia and with women's contribution to agricultural production. Both AusAID and the Government of Cambodia must continue to recognise that until more emphasis is placed on attracting women into agricultural education and professions, their numbers will not reflect the general contribution of women to agriculture.

2.6. Performance Ratings for the Activity Monitoring Brief

The Activity Ratings for the Activity Monitoring Brief, as part of the Activity Management System are:

		Rating
Ratings against Objectives	Development	4
	Maintenance	3
Rating of Appropriateness of Objectives		5
Overall Performance	Development	4
	Maintenance	3
	Training	5
Other Indicators	Contractor Management Performance	4
	Partner Agency Inputs	3
	Financial Sustainability	3
	Institutional Sustainability	3
	Procurement Progress	5
	Technical Aspects	5
	Environmental Aspects	5
	Social Aspects	4
	Gender	4
	Population	97

Ratings are according to the grades specified for the Activity Monitoring Brief. 5 is a top score; 2 is a low score; 97 is not applicable

3. VIETNAM-IRRI PROJECT

3.1. Background to the Project

In the 1980s Vietnam embarked on a program of economic reform. This followed thirty years of war, and a period of centralised state planning in which land was collectivised. Agrarian production and distribution was extensively collectivised, particularly in the north. Economic liberalisation resulted in de-collectivisation and a move to increased private sector production and distribution. These economic reforms have had uneven effects on levels of welfare and poverty. Poverty remains concentrated in the rural populations (Kerkvliet and Porter 1995).

3.1.1. Development Context

Vietnam's economy is largely concentrated in agriculture which, in 1990, formed 39% of Gross Domestic Product (GDP) (Kerkvliet and Porter 1995, Table 1.1). About 80% of the population live in the country side. Rice is Vietnam's staple food crop and its production is the nation's principal generator of employment and income. Rice production declined over the period 1942-86 (Pingali and Xuan n.d.) but has risen since de-collectivisation and the opening up of markets. Rice exports have been an important foreign currency earner in recent years. The quality of Vietnamese rice has been a limiting factor in competing with other countries on the international market.

Constraints to rice production to the mid 1980s included a lack of human resources and facilities available for research, lack of varietal choice, inadequate production, poor marketing infrastructure, and the limited adoption of modern rice varieties and production technologies.

By the early 1990s environmental issues concerning urban and rural development were beginning to be of concern to the government (Socialist Republic of Vietnam 1993).

3.1.2. Description of Project

The IRRI-Vietnam Project was undertaken in the context of a series of Memoranda of Understanding (MOU) between the Government of Australia (GOA) and IRRI to address the problems of rice production in the Indochina region. For assistance provided from 1985 to 1991, there were no design documents and no official aid program between Australia and Vietnam.

Australia's total contribution to the Vietnam-IRRI Project, from 1985 to 1994, was approximately AUD 2,100,000.

1985-86	AUD 150,000
1986-87	AUD 570,000
1988-90	AUD 600,000
1991-94	AUD 780,000

From 1985 to 1987, Australia's contribution was for short term training at IRRI, and for translation, publication and distribution of IRRI publications. From 1988 to 1991 support was for collaborative research, and for non-degree training of Vietnamese scientists at IRRI (IRRI 1991b). Funds from this grant were exhausted in December 1990.

A Work Plan meeting in late 1989 highlighted the need for improved coordination of rice research in Vietnam and a 'project approach' was adopted to attempt to overcome this problem. In 1991, a further three years of AusAID funding was approved for technical collaboration between IRRI and local Vietnamese institutions. AusAID funding was also intended to cover training. The 1991-1994 project was a continuation of the Vietnam-IRRI project that was undertaken from 1988 to 1990, and it was expected to complement other IRRI projects in Vietnam. The broad objectives of the project were to improve food self-sufficiency and food security. These objectives were consistent with Vietnamese Government policy. These objectives were to be achieved through the increased production of rice, and the productivity of rice based farming systems, with an emphasis on sustainability (IRRI 1991b). Activities were concentrated in the main rice growing regions of the Red River Delta and the Mekong River Delta. Research and training focused on the following themes which were consistent with IRRI strengths:

- Integrated pest management (IPM)
- Integrated nutrient management (INM), including the role of leguminous crops
- Water management.

Short-term training courses at IRRI, attendance at conferences and workshops, visits to IRRI for consultation with senior scientists, 'hands-on' collaborative research, and support in the form of essential research supplies and equipment were designed to address the institutional constraints to research in these areas. The 1991-94 assistance culminated in a national workshop and proceedings, which presented research papers and recommendations arising from the Vietnam-IRRI cooperation.

3.2. Environmental Assessment

Prior to 1991, most of the activities centred around the funding of training and publications. Environmental impact from such activities is unclear although it is evident that the trained scientists did develop an environmental awareness which is reflected in their approach to subsequent research. The 1991 project design document became the subject of intense appraisal within AusAID which questioned environmental aspects of IRRI technologies on the incorrect premise that they required heavy use of fertilisers, pesticides and herbicides (AusAID 1991a). The appraisal comments included a recommendation to emphasise the positive and negative environmental implications of the proposed research activities and make arrangements to monitor and report on these

implications in annual reports (AusAID 1991b). The appraisal assessment summary recorded Environmental Viability and Sustainability as "I" (Inadequate).

The design document was revised by IRRI and resubmitted in June 1991. The subsequent appraisal (AusAID 1991c) found the IPM component would lead to environmentally friendly pest control strategies, the INM component would lead to improvements in fertiliser use and the water management component would assist in developing sound reclamation strategies for acid sulphate soils. The environmental assessment was that "the project is expected to make a positive contribution to the environment in terms of providing alternatives to the use of pesticides and in land reclamation". It reiterated that environmental issues would be monitored and presented in the annual progress reports. The appraisal assessment summary recorded Environmental Viability and Sustainability as "Good".

3.2.1. Policy Guidelines

Although AusAID's environmental (and gender) guidelines were used in the design appraisal of the 1991 design document, there is no indication that they were made available to the collaborating institutions in Vietnam. Although the design is targeting environmental issues of pest management, nutrient management and water management, the environmental significance is not explicit in IRRI documentation and it would appear that IRRI has not monitored and presented environmental issues.

It is unclear as to what the Vietnamese Government's policy on environment was in the early years of the project. In 1992 the National Plan for Environment and Sustainable Development 1991-2000 was approved by government and appears to be the only official government policy document on environment (IUCN 1998). The National Plan has five specific objectives, all of which relate to agriculture, with one in particular ensuring the sustainable use of Vietnam's natural resources by managing intensity and patterns of use. The Law on Environmental Protection was passed in December 1993 (GOV 1994). Article 14 requires the exploitation of agricultural land, forest land, and land for aquaculture to comply with land use plans, land improvement plans and ensure ecological balance. It also requires that the use of chemicals, chemical fertilisers, pesticides and other biological products must comply with legal stipulations.

The evaluation team applied AusAID screening guidelines of 1989 to conclude the project had a neutral to positive impact of the environment.

3.2.2. Environmental Impacts

AusAID funding contributed to INM, IPM, and water management. AusAID funding may also have assisted germplasm collection and varietal improvement. However, the evaluation could not identify all AusAID funded activities, making it difficult to evaluate their direct environmental impacts. AusAID required that environmental (and gender)

issues be monitored and findings presented in the annual progress reports (IRRI 1991b). The evaluation could not find annual reports in AusAID (Canberra or Hanoi), the Ministry of Agriculture and Rural Development (MARD), or the IRRI office in Hanoi.

It is not the purpose of the evaluation to document the environmental impacts of agriculture in Vietnam. However, the evaluation team was aware that there were significant environmental issues which needed to be addressed for the lowland rice producing areas (the evaluation did not consider uplands). These include:

- high use of insecticides due to the intensification of rice production which may be causing pesticide poisoning symptoms in 12 - 20% of users (Plant Protection Institute 1998);
- high use of herbicides as a result of the adoption of direct seeding for crop establishment;
- increased flooding due to the concentration of run off;
- increased salinity of irrigation water due to sea water incursion caused by decreased river flow in the dry period of the year and to the reclamation of delta flood deposits;
- increased downstream water acidity and concentration of iron and aluminium due to cultivation of acid sulphate soils (Minh et al 1995); and
- population pressures associated with clearing and reclamation of land.

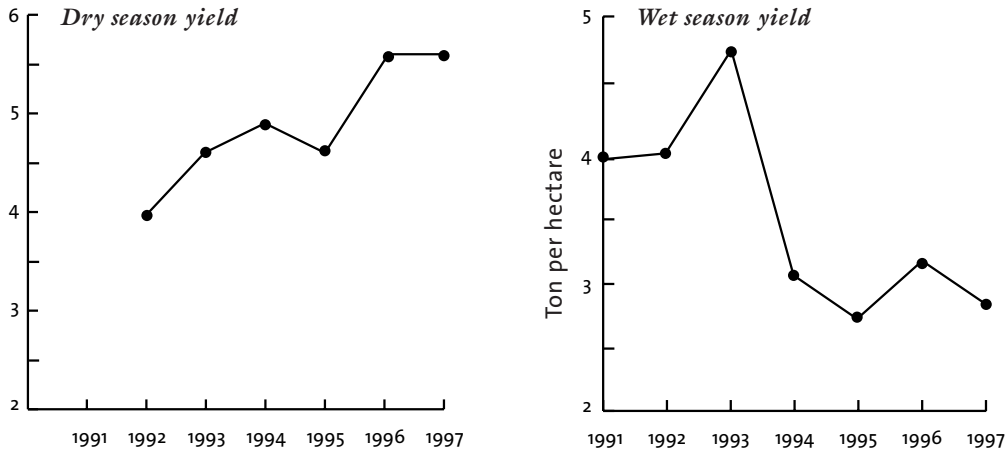
The national agricultural research system is addressing the salinity and acidity problems through INM, water management and the development of resistant varieties. It is addressing the pesticide use through IPM and varietal improvement.

The National Institute for Soils and Fertiliser acknowledged the INM activities funded by AusAID assisted with training and research to provide a better understanding of plant nutrient management, resulting in a more efficient use of fertilisers. However, the impact depends on how the results are translated into recommendations and their adoption by farmers. This was not within the scope of the Vietnam-IRRI project but there is some anecdotal evidence to suggest that the research has contributed to recommendations for more efficient use of urea applications in the Red River Delta which may reduce contamination of water resources.

National scientists, trained under the IRRI project, are cooperating in an international effort (the MEGA Project) to identify the phenomenon whereby farmers are applying more and more inputs to get the same, or even lower, yield. During discussions with these scientists about research into such declining productivity in intensive farming systems, it was unclear whether this is occurring in Vietnam. If it is, it has significant environmental ramifications.

If intensification of rice farming is leading to a build up of micro-organisms, land degradation, and/or nutrients leaching into groundwater and surface water, measures must be taken to arrest the decline. In an incidental examination of yield data for the Red River Delta, the evaluation team found that yields in the wet season crop do appear to have declined over the last several years (see graph). The evaluation team does not know if this observation has been confirmed by others researching rice in Vietnam.

Red River Delta average rice yeild



Source: Vietnam Statistical Yearbooks

In water management, the AusAID funded activities were described by Can Tho University as being the identification of the management requirements for, and downstream impacts of, developing acid sulphate soils. The results have led to the raising of awareness in government of the issues associated with developing acid sulphate soils. Can Tho University also suspects eutrophication of some waterways arising from excessive use of fertilisers and a monitoring program has commenced. This is outside AusAID funding.

The evaluation team could not identify specific IPM activities funded by AusAID under the Vietnam-IRRI project.[8] BPH is the most significant pest in lowland rice in Vietnam and farmer practices involve heavy applications of insecticide. The IPM research aims to enhance the biodiversity of natural enemies in rice fields. Anecdotal evidence suggests farmer adoption is slow and use of insecticides continues to increase.[9]

8 AusAID has been supporting Vietnam's National IPM Program through AusAID's bilateral and regional programs. IPM in Vietnam is managed and implemented by the Vietnam Plant Protection Department and FAO.

9 Personal communication with Cuu Long Rice Research Institute.

Labour saving technologies of broadcast direct seeding are being adopted by farmers. Without good water management this leads to weed infestations which are controlled by use of herbicides. Research and extension is underway to reduce the use of herbicides. AusAID is not funding such research but the Vietnamese scientists trained by IRRI are involved.

The displacement and possible loss of traditional Vietnamese rice varieties by IRRI varieties is being addressed through a comprehensive collection and storage program. Can Tho University, Cuu Long Rice Research Institute (CLRRI) and the Vietnam Agricultural Science Institute (VASI) hold extensive collections of traditional rice varieties and wild relatives. There is a program to duplicate these collections at IRRI in the Philippines for long term security. Just how much of this has been funded by AusAID is unclear.

3.3. Implementation Assessment

This evaluation covers the period from 1985 to 1994. The impact of training was evident in the competence of scientists trained by IRRI, and the appreciation of those met by the evaluation team, but it was difficult to identify research activities directly supported by AusAID funds. The only project design document available was that prepared in April 1991, appraised by AusAID and revised in June 1991. As indicated in 3.2.2, there was no evidence available to the evaluation team of reporting by IRRI to AusAID.

3.3.1. Implementation Achievement

The proceedings of a Conference held in Hanoi in May 1994 (MAFI 1995) outline the achievements of rice research under the Vietnam-IRRI Program, and chart new paths for research for sustainable growth. The conference was partially funded by AusAID. A number of the papers are derived from collaborative research supported by AusAID. The papers are of a high scientific standard and many would have positive impacts on the environment if their results were translated into recommendations adopted by farmers. Whether this is the case is not reported in the conference proceedings.

There is no doubt that farming systems have intensified during the ten years of AusAID involvement with IRRI. Yields of improved varieties are now double that of traditional varieties, reaching 6 t/ha. Up to three crops per year are planted compared to one of traditional varieties. Average yields across the nation have increased as a consequence, and total production is nearly three times that of 20 years ago. This has contributed to food security in Vietnam, although there are regional differences. Adoption of IRRI varieties or IRRI derived varieties (estimated at 70%-80%) is widespread in the lowlands and more pronounced in the irrigated areas.

Between 1986 and 1994, the following candidates trained at IRRI: Four PhD, 21 MSc, three research Fellows, 59 non-degree and on-the-job participants, and 142 group

participants. Of these, an average of about 25% in each year were women (Matheny 1995). The exact number funded by AusAID from 1986 to 1994 is not clear, but from 1988 to 1994 AusAID supported 112 participants for non degree training at IRRI. Allowing for Australia's input from 1985 to 1987, it would seem that Australia has been the major contributor enabling Vietnamese scientists to be trained at IRRI. The interaction and dissemination of knowledge between Vietnamese scientists and other scientists in the region was furthered through workshops, seminars and meetings.

3.3.2. Technical Impact

IRRI and a number of Vietnamese agricultural research agencies have been involved in improving rice productivity since 1968. The cooperation gathered momentum in the late 1980s and was assisted by Australia from 1985 to 1994. The scope of the improvement in technology through this period included varietal improvement, IPM, INM, and mechanisation. Australia's contribution featured technical training, while other donors also contributed to strengthening some of the institutions, in particular CLRRI.

A total of 63 rice varieties had been released from this program by 1994. This included contributions from the CLRRI, Can Tho University and VASI. The major contribution of varieties in the Mekong Delta has come from CLRRI. The varieties were selected from IRRI germplasm and, more recently, from breeding programs conducted by these agencies.

The features of these varieties include very short duration growing season, high yield, resistance to pests and diseases and reasonable eating quality. The most significant impact of these varieties has been to allow the cultivation of two to three crops per year in many regions where only one was grown before. The area sown to rice has increased from 4.6 million hectares in 1970 to 7.1 million hectares in 1997. The additional crops are grown in the spring/summer and summer/autumn periods. Traditional Vietnamese varieties still occupy a significant portion of the rain fed ecosystem in the Mekong Delta. This is due to their superior quality and suitability for deep water cultivation due to height advantage over the IRRI derived material. Both these aspects are being addressed in national breeding programs. The national average yield has risen over this period from 2.1 t/ha to 3.9 t/ha. Hybrid rice varieties are being developed which are reported to increase yields by 20% - 30% over the improved varieties, using technology sourced from China and from IRRI.

There has been an upsurge in insect pest damage, particularly BPH, with the greater intensification of rice growing. The pest population can be reduced through lack of a susceptible host. However, there is no period of the year in the Mekong Delta where there is no rice crop, and a much reduced rice free period in the Red River Delta.

Many of the introduced IRRI varieties had high levels of BPH resistance. Genetic changes in BPH have allowed it to attack previously resistant varieties. Chemical control

technology for BPH was introduced by IRRI in 1968 and has resulted in unacceptable pesticide usage in Vietnam. An IPM strategy was introduced by IRRI in 1985. This includes the fostering of predators and parasites of rice insect pests and alternative genetic solutions including the transfer of BPH resistance genes from wild relatives of rice.

The training of Vietnamese scientists, and the collaboration with IRRI scientists, has had a considerable technical impact in the research institutions on Vietnam. The funding of equipment and research materials has had an impact although the items provided appear few compared to the need. Scientists are continuing in their fields of training and those interviewed by the evaluation team are aware of the environmental issues surrounding agriculture in Vietnam.

The breeding problems currently facing Vietnam, such as the BPH, will require more sophisticated solutions that may include biotechnology. Much of this technology has been developed in the private sector who will require a financial return for its use. It was not apparent to the evaluation team that there was sufficient appreciation in Vietnam of the biotechnology options available or consideration of how these may be safely deployed. Intellectual property (IP) resulting from the varieties developed may provide a revenue stream that can be used to gain access to the required biotechnology. Again, there is insufficient appreciation of IP considerations which are, currently, a major issue for plant breeding.

Many hundreds of experiments are carried out in the course of a large agricultural research project. The data generated has value that transcends the immediate application and region. This is the situation in Vietnam but, as yet, there is no provision for electronic data storage or access by other scientists. International database systems are available through IRRI which would guarantee long term data storage, provide access to Vietnamese data by other agencies and allow Vietnam access to data generated elsewhere.

3.3.3. Economic Impact

The nature of assistance to the Vietnam-IRRI project was such that the economic impact cannot be quantified. Financial and economic analysis of Australia's contribution was not considered relevant in the project design (AusAID 1991b).

The returns to developing countries from agricultural research are generally regarded as being very high, and include social and economic benefits beyond the agricultural sector (AusAID 1997). It is certain that the IRRI contribution to provision of rice varieties, varietal improvement, training of Vietnamese scientists, and collaborative research, has had a major impact on rice production in Vietnam. The Australian assistance between 1985 and 1995 has been a tangible part of this.

Productivity has increased substantially (Table 3.1). Rice available for consumption has continued to increase faster than population growth, adding to food security. Rice exports have become a major earner of foreign exchange for Vietnam which is now the world's second largest exporter of rice. The income and wellbeing of the majority of rice farmers is considered to have improved over the last ten years with the increased productivity, and particularly over the last two years, with the increased world price for rice.

Productivity gains have continued to be achieved in part because of the varietal improvement, collaborative research, and strengthened capacity of the Vietnamese scientists assisted by the Vietnam-IRRI Project.

Table 3.1 Vietnam rice production

	Unit	1975	1980	1985	1990	1995	1997
Area	'000 ha	4900	5500	5700	6100	6760	7100
Production	'000 t	10437	11550	15846	19459	24944	27690
Yield	t/ha	2.1	2.1	2.8	3.2	3.7	3.9
Export	'000 t	(148)	(193)	60	1600	2300	3700
Domestic cons'n	'000 t	10585	11743	15786	17859	22644	23990
Cons'n growth	% per yr		2.1%	6.1%	2.5%	4.9%	2.9%

Source: Vietnam Statistical Yearbooks

Attention of scientists is now focusing on the quality of rice, control of insect pests, hybrid rice, environmental impacts of rice production practices, and production management improvements to achieve a sustainable high value enterprise. Integrated pest management, appropriate nutrient management, farming system developments, and mechanisation are contributing to reduced chemical and fertiliser inputs, improved incomes, and the opening up of other economic opportunities to the rice based rural populations.

3.3.4. Institutional Impact

A major impact of the Australian contribution has been human resource development through training and collaborative research, and through provision of materials and facilities to institutions involved in agricultural research in Vietnam. The evaluation team understood that many of the people trained with Australian assistance to the Vietnam-IRRI Project are still with their institutes and universities. They are conducting competent and worthwhile research, and are playing a role in teaching the next generation of agricultural professionals. The facilities, and much of the equipment provided with Australian funds, are still in use.

Many scientists and technicians trained during the period of Australia's involvement appear to be sensitive to environmental issues and problems. Research efforts are now being

directed at minimising environmental problems, and improving rice quality, as far as possible without sacrificing productivity.

In the period from 1986 to 1990, Australia funded most of the training of Vietnamese professionals at IRRI. Sixty-seven Vietnamese scientists received training with Australian assistance (out of 83 total) during 1988 to 1990 (IRRI 1991a, MAFI 1995). From 1991 to 1994, a further 45 (out of about 100) were trained at IRRI. Australian assistance also supported visits to Vietnam of a number of IRRI professionals to provide courses and training to scientists and technicians in country, and to participate in research.

There were some clear examples of the training provided by the project that suggest the funding was effective, although the contributions made by AusAID are not well known. The exception was at Can Tho University where a number of the faculty members were known to be recipients of AusAID sponsored training and had maintained a research interest that was contributing to the resolution of an environmental problem (acid sulphate soil) as well as productivity (new varieties). This group was also involved in the training of future Vietnamese agricultural scientists. The training is of particular relevance to this group because of their geographic isolation. Staff at Can Tho University expressed an appreciation for the straightforward, clearly focused IRRI approach. At VASI Hanoi, staff trained with AusAID funding now lead a hybrid rice breeding program which is delivering a substantial yield improvement over the IRRI inbred varieties. In general, the human resources available for rice research in Vietnam appear to be well trained, enthusiastic and capable.

Australia was also the major contributor to institutional strengthening of Vietnam-IRRI relations and rice research capacity in the period from 1986 to 1990. The extension of assistance from 1991 led to the establishment of formal ties among IRRI, MAFI (now MARD), and the Ministry of Education and Training a year later (IRRI 1993). Australia provided the vehicle and computing equipment for a newly established Vietnam-IRRI Office.

The institutions visited by the evaluation team appear to be strong in trained personnel, and in expertise. Research infrastructure appears to be limited, presumably because of a lack of funds. The laboratory equipment seen appeared to be fairly rudimentary. Future funding could be an issue. At present the research institutions depend much on bilateral and multilateral donors, and on international research organisations. In future, much time of research agencies will have to be directed to attracting funds from a wide range of sources if their work is to be sustained.

The collaboration with IRRI provides considerable scientific mentoring through visits by IRRI scientists, the development of a strong regional network of rice scientists and the conduct of conferences and workshops. However, at VASI, a view was expressed that direct funding would now be preferred rather than through a third party. They argue that less funds would be needed for administration, thus releasing more for the project, and that more use could be made of local scientists.

3.3.5. Social and Cultural Impact

Technology transfer: The revised Project Design Document (IRRI 1991b) for the Vietnam-IRRI Rice Research and Training Project required that IRRI undertake a study of existing research-extension linkages at the cooperating institutions and that recommendations for mechanisms to enhance the transfer of technology to farmers be presented for discussion at the National Workshop. The study could not be located for evaluation.

The extension service within the Ministry of Agriculture and Rural Development was established in 1993. Prior to that time, research institutions, along with NGOs and other agencies, conducted extension activities. That practice is continuing with scientists having direct contact with farmers at field days and demonstrations. At Can Tho University, students worked with farmers to introduce new technology developed by the University. The University signs a contract with farmers to compensate them for any loss of production which might occur as a result of the activities. There is a continuing need for the involvement of research institutions in extension because only about one third of communes are currently serviced by extension workers. Around 10% of extension workers are women.[10] Extension methods appear to be top-down.

Representatives of research institutions reported some dissatisfaction with the current research-extension relationship. Extension received greater funding than research. It was said that extension workers reinterpreted research recommendations according to what they felt suited local conditions. This may contribute to incorrect agrochemical usage.

Social Dimensions of Technology Adoption. Social aspects are sometimes neglected in projects aimed primarily at scientific advancement and increased productivity. The picture in the AusAID Vietnam-IRRI Project is complicated by the difficulty of identifying precisely how AusAID funding was used, which institutions were involved and what activities were implemented. The social aspects which are discussed below relate more generally to the intensification of rice production in Vietnam of which the AusAID funded project was only a small part.

During the project period a government priority was the intensification of irrigated rice cultivation in lowland areas, especially the Mekong River Delta and Red River Delta. The use of improved rice varieties and higher levels of inputs such as fertilisers and pesticides, substantially raised the rice production of many farming households and enabled them to rise above subsistence level. Until recently little attention was paid to the importance of rainfed traditional rice and non-rice crops produced by farmers, including ethnic minority groups, in upland and mountainous areas.

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10 Personal communication, Vice Director of Agriculture and Forestry Extension, Ministry of Agriculture and Rural Development.

The good returns now being realised by rice growers is discouraging diversification. As part of the Vietnam-IRRI Project, Can Tho University was requested by the local government authority to introduce vegetables in a remote part of the northern Mekong Delta area. Adoption was low because, not only was transport and marketing a problem, the high returns farmers received for rice was a disincentive to the production of other crops.

AusAID funding was not directed at the village level and the research extension linkages were not addressed. The evaluation found that technology transfer was directed to farmers considered 'progressive' or 'skilled'. These farmers were selected by other commune members. They are likely to be the ones who are most influential and have the most resources at their disposal in terms of labour, land and capital and can make more use of the new technology. For this evaluation it was not possible to assess the extent to which technology transfer occurred from these more successful farmers to other farmers, including women.

There are regional variations in farm size. In the Mekong Delta region, average farm areas greater than 1 ha contrast with about 0.3 ha in the Red River Delta. A growing gap between well-off and poorer farmers is reported by scientists at research institutions in the south. This may be partially related to the capacity to make use of new rice technology, and to the greater risks involved with higher inputs and the costs involved. The Mekong Delta with its larger landholdings is making increased use of mechanised methods. Land tenure is also changing as poorer farmers sell their land. Ill health is frequently the single most important cause of indebtedness for the bottom 15% of the population (ADUKI 1995).

The project, through its research into IPM strategies, may have helped to raise awareness of appropriate pesticide use and the importance of natural enemies for pest management. In addition to environmental benefits, this is important for health. Reports of illness, birth deformities and miscarriages amongst users of pesticides who have not participated in IPM field schools were reported in a Plant Protection Institute workshop held in 1998. The studies at this workshop also reported that people who had not participated in IPM field schools had little understanding of the need to use protective clothing, that knowledge of pesticide use was poor, and there was little understanding of the impact of chemicals on health.

3.3.6. Impact on Women

Institutions which were involved in the Vietnam-IRRI Project and contacted for this evaluation had not been made aware of AusAID's gender guidelines.

The revised project design document (IRRI 1991b) required that a gender issues specialist spend 2 weeks in Vietnam during the first year. This requirement appears not to have been fulfilled under AusAID funding. A gender specialist did visit but was funded

by UNDP. A paper analysing the roles of farm women in the Mekong Delta was written by the gender specialist in collaboration with women scientists from CLRRI in the context of UNDP's mission to strengthen that institution. The paper was presented at the 1994 National Workshop (Chi *et al* 1995).

The revised Project Design Document also required that gender issues be monitored and presented in annual reports. The only progress report available to the evaluation team detailed expenditures for 1993-94. It did not discuss gender issues. It did record, however, that during that year gender analysis training was provided to one Vietnamese scientist.

Women scientists. Although no precise data was available concerning the number of women scientists who obtained training under AusAID funding, estimates obtained point to women comprising a good proportion of the scientists trained. Across five institutions contacted for this evaluation, women were estimated to have filled between 22% and 50% of places in overseas training.

Women farmers. Women are important to rice cultivation in Vietnam. In the Mekong Delta, women contribute between 44% and 48% of total farm labour input in various rice cropping systems and have taken over many tasks traditionally performed by men (Chi et al 1995). In addition, about 27% of household heads are estimated to be women. Many of these households, especially those where the ratio of dependents is high compared with labour availability, are particularly vulnerable to poverty and landloss (AusAID 1998). The implications for women's well-being of their long working days[11], including their responsibility for managing the household, taking care of the children, and attending to the health and education needs of the family, are acute. The project did not analyse women's participation in its specific activities or the impact of introduced technology on women's work.

While decision making regarding rice production was usually made by men, the involvement of women in intensive rice cultivation required them to obtain more information and skills, especially regarding crop management (Chi et al 1995). As noted above, extension targeted 'progressive' farmers. There appears to have been a significant difference between the north and the south in the number of women who were regarded as 'progressive' farmers. In the south, only about 5% to 10% of farmers who attended field days and demonstrations held by the research institutions were estimated to be women. However, in the north much higher levels of women's participation, estimated at around 40-50%, were reported by institutions supported by the project.[12]

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11 Estimates of the length of rural women's workday, including productive and domestic and childcare work, range from 12 to 16 hours compared with 6 to 8 hours for men. Personal communication.

12 A marked regional difference between women's participation in agricultural training and education is also apparent in reports regarding women's involvement in the National IPM program (however, it should be noted that this is not part of the Vietnam-IRRI Project). A 1996 IPM Country Brief states that almost 46% of IPM trainers in the north were women while in the south only 25% were women.

This difference may be partially linked to underlying socio-economic and political conditions, and the higher levels of outmigration of men in the Red River Delta as they search for off-farm income earning opportunities, leaving women in charge of the farm.[13]

3.3.7. Performance of Management

IRRI has provided exceptional scientific support to the Vietnamese rice research program. However, the lack of reporting to AusAID, particularly in relation to environmental and gender issues, is seen as a poor performance of IRRI management. It also reflects badly on AusAID's performance monitoring in not seeking the reports when they failed to arrive. The reporting requirements were clearly specified in the MOUs and design document. If the reports were provided, then they were lost to AusAID, MARD, and IRRI Hanoi.

3.3.8. Cost Effectiveness

Australia's contribution to the cost of training Vietnamese scientists, support of collaborative research, assistance with publications and papers, and finally the proceedings of the Vietnam-IRRI workshop in 1994, was relatively modest. It averaged about AUD 200,000 per year over 10 years. Given the relatively small amount, the contribution is judged to have been very effective. The Vietnamese rice research community appears to be competent, enthusiastic and well mentored by IRRI. Rice research in Vietnam, and collaborative research with IRRI, has contributed greatly to improvements in productivity. There is an awareness and appreciation among rice research personnel of environmental issues, and evidence of environmental concern in research being undertaken.

The Vietnam-IRRI Project must be regarded as generally successful. The Australian contribution was particularly cost effective as it complemented the IRRI resources, and was aimed at many university research staff who are now teaching, and training future research staff.

3.4. Sustainability of Outputs

From 1986 to 1991 the project outputs were training of Vietnamese scientists, translations and publications. These are seen to be sustainable in that many trained scientists are now training new scientists in Vietnam. In institutions such as the Can Tho University, staff trained by IRRI are now lecturing to undergraduates.

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13 One report (ADUKI 1995) notes that in one village located 70km from Hanoi there were very few men of working age living in the commune.

The design document 1991-94, produced for AusAID funding, specified outputs across three components of IPM, INM, and improved water management. Training figures and papers produced from research are the only indicators of output. The evaluation found that, in all three components, the research is continuing with designs prepared by Vietnamese scientists trained by IRRI and funding from the Vietnamese Government or other donors. It is a credit to the Vietnamese scientists, and an indicator of sustainability, that they are able to maintain high standards of research with limited resources in terms of materials and equipment. Many scientists are continuing to publish research papers.

The project design (IRRI 1991b) noted that the institutional sustainability of IRRI's approach is demonstrated when IRRI's relationship has evolved to that of collaborating partner rather than technical adviser. This would appear to be close to reaching a reality and the IRRI Office in MARD appears as an institutional entity, serving as a focus for collaboration between the various research institutions around the country and IRRI in Los Baños.

An issue of sustainability for research is whether the results are translated into recommendations for extension to farmers and how such recommendations are adopted. The project did not address this very critical issue and this is a deficiency in its design. This is not to say that the project had to contain an extension component, but it needed to identify how research results would be transferred to the field. It would appear that extension is a relatively new department in the Ministry of Agriculture and Rural Development and the institutional relationships between research and extension are still evolving. The adoption of technology developed by research, except for the new varieties released, appears to be slow.

3.5. Lessons Learned

The Vietnam-IRRI rice research program has been very effective, and Australian finding has contributed to the success. IRRI has been able to provide well targeted training for research scientists using its global resource base. A lesson from this project is that collaboration through a well respected highly professional research institution such as IRRI is an effective way for AusAID to fund research and training in the agriculture sector of a developing country provided:

- reporting, design, legislative and other requirements related to AusAID's participation in the project are fully met;
- Australian identity is maintained

The evaluation team found it difficult to track reporting of activities implemented with Australian funding and suspects that reporting requirements were not fulfilled. A lesson is that when funding projects through other institutions, AusAID must still make efforts to ensure that the reporting and project design requirements are complied with.

When funding projects through other institutions, Australian identity can be lost, especially when the input is small. If Australia wishes to have its contribution recognised, it must make a concerted effort beginning at the design stage.

Changing to three rice crops per year has aggravated pest problems. Clearing acid sulphate soils has caused acidification of runoff. Changing agricultural practices often has unintended consequences such as impacts on the environment. The lesson is that when changes to agricultural practices are implemented there should be particular awareness of impacts that will have to be addressed. These should be anticipated and assessed at pre-feasibility stage and, if the project is feasible, appropriate components added to the design.

3.6. Performance Ratings for the Activity Monitoring Brief

The Activity Ratings for the Activity Monitoring Brief, as part of the Activity Management System are:

		Rating
Ratings against Objectives	Development	4
	Maintenance	3
Rating of Appropriateness of Objectives		5
Overall Performance	Development	4
	Maintenance	3
	Training	5
Other Indicators	Contractor Management Performance	3
	Partner Agency Inputs	3
	Financial Sustainability	3
	Institutional Sustainability	3
	Procurement Progress	4
	Technical Aspects	5
	Environmental Aspects	5
	Social Aspects	4
	Gender	4
	Population	97

Ratings are according to the grades specified for the Activity Monitoring Brief. 5 is a top score; 2 is a low score; 97 is not applicable

4. LAO UPLAND AGRICULTURE DEVELOPMENT PROJECT

4.1. Background to the Project

The Lao Upland Agriculture Development Project (LUADP) was funded under IDA credit[14] with parallel financing of technical assistance for implementation provided by the Government of Australia (GOA) and the Government of France. The GOA contribution was managed by an Australian consortium appointed by AusAID.

4.1.1. Development Context

From 1975 to 1986, economic development in Laos was based on centralised planning and controls. The state owned the means of production and distribution. By 1989, a more liberalised, market-oriented approach was operating. Shifts included the deregulation of prices and trade, the elimination of farm subsidies, the removal of private sector restrictions, the liberalisation of commercial credit, and fiscal and public enterprise reform. In agricultural production, the collectivised system of the previous period was substituted by family farm production units. Decentralisation of administrative arrangements was a slower process which progressed through the early 1990s (ACIL 1996).

The reform process was supported by the World Bank and the International Monetary Fund (IMF) with targeted loans. In addition, the Asian Development Bank provided an Agricultural Program Loan which addressed human resource development, research, extension, irrigation and seed multiplication.

Agriculture, including forestry, dominated the national economy (World Bank 1989). However crop yields and productivity were amongst the lowest in Asia. Little use was made of mechanisation or other inputs. Agricultural research and extension were constrained by low levels of investment and operating funds and a shortage of trained personnel.

Food crop export earnings were low. Rice, the staple, was consumed locally. Of this, about half was produced in the lowlands, while half was upland rice. Non-rice crops were mainly for home consumption, apart from coffee produced in the south.

14 A concessional loan from the International Development Agency (IDA) of the World Bank

Extensive upland areas were under shifting cultivation which was a wasteful and destructive agricultural system. The Lao Government considered that strategies needed to be developed to stabilise upland agriculture. This did not only include improved land management in the upland areas. Intensified lowland rice production with supplemental irrigation in both wet and dry seasons was seen as a key to stabilising the uplands by reducing the need to plant upland rice.

4.1.2. Description of the Project

The project was prepared by the World Bank in response to the Government of Lao PDR (GOL) request to support its efforts to reduce rural poverty, expand export earnings, improve food security, control soil erosion and strengthen key agricultural institutions. The central strategy was to achieve productivity gains through an integrated series of development initiatives, from rehabilitation of past investments in irrigation, livestock feedmill, coffee plantations and feeder roads, to the development, transfer and adoption of improved technology and the provision of essential inputs and services. The five year project was to cover Champassak, Saravane and Sekong Provinces on the Bolovens Plateau in the south, and Vientiane Municipality and Province in the north.

The Staff Appraisal Report (SAR, World Bank 1989) described the main project components as:

- intensification of upland crop production, mainly coffee, soybeans and other cash crops and valley floor irrigated production of rice and other food crops through the provision of equipment, inputs and support services, and the development and transfer of improved and environmentally safe technologies;
- rehabilitation of existing small scale gravity irrigation schemes and establishment of pilot irrigation operation and maintenance arrangements based on adequate cost recovery from beneficiaries;
- feeder road rehabilitation and maintenance and improvement of village water supply; and
- technical assistance and training.

AusAID was to cover overall project coordination, planning, programming, monitoring and evaluation, in addition to all development activities in the northern project area including irrigation rehabilitation, research, extension and crop production. It would also support development of upland crops other than coffee development in the south. French technical assistance was to focus on coffee development, including research, extension, production, processing and marketing.

Changes in administrative arrangements between the central government and the provinces had important consequences for the project. The agency responsible for project implementation was changed, AusAID's Technical Assistance (TA) needed refocusing and, in many cases, new officials needed training.

In October 1991, AusAID approved a Project Implementation Document (PID, ACIL 1991c) which detailed AusAID's contribution. The PID became the design document for all further AusAID funding.

However, it is unclear whether the PID was provided to the World Bank. In any event, the SAR continued to be the Bank's design. From the outset this placed the project in the difficult situation for the managing agents, AusAID, GOL and the World Bank in having two designs to contend with. The SAR focused on physical inputs and disbursements while the PID concentrated on technical assistance and community development.

4.2. Environmental Assessment

A focus of the project was to develop technology and infrastructure that would reduce shifting cultivation in the uplands. The project design also included roads and irrigation schemes which themselves had potential environmental impacts. Reduction of the area of disruptive forms of slash and burn cultivation was a positive environmental objective.

4.2.1. Policy Guidelines

There was no environmental impact analysis for the project at the design stage (1989-91). AusAID did have activity guidelines in 1989 and the World Bank had Environment Sector Guidelines in 1991. However, in both cases, the guidelines were new and untested. AusAID required the project to prepare an Environmental Assessment and Management Plan (EMP, ACIL 1993b) to ensure it conformed with its own policies and obligations under the Environment Protection (Impact of Proposals) Act 1974. This report was finalised in March 1993. It did not provide for an environmental assessment but rather provided a plan which offered the opportunity to contribute positively to the environment.

Lao PDR has no environmental legislation. The existing decrees relate mainly to forestry. In 1993, the EMP expected a major part of legislation to be in place in 6-9 months. The evaluation team was told legislation is now expected to be passed in February 1999. Without local legislation, and in the absence of any World Bank environmental assessment, AusAID was well advised to apply its own guidelines. However in its position in the project, as a provider of technical assistance without authority in infrastructure implementation, there was a limit to its influence in ensuring environmental controls.

In Laos, activities relating to streams and rivers are now covered in the Water and Resources Laws, November 1996 (GOL 1996). However this legislation only became law when the project was nearly completed.

4.2.2. Environmental Impact

Despite the lack of environmental law, the evaluation team found government staff were conversant with the environmental issues, particularly those associated with the sustainable management of the uplands.

The evaluation team applied the AusAID screening guidelines of 1989 to conclude that the project has had a neutral impact on the environment as shown in the text box.

ENVIRONMENTAL ASSESSMENT

(Using AusAID Screening Guidelines – 1989)

1. Soil and land management is a significant issue. The project has provided irrigation in the lowlands to reduce the need for slash and burn of uplands. It has introduced fruit tree cultivation to substitute for shifting cultivation.
2. Water management is a significant issue. Irrigation is directed at existing schemes and is not making extra demands on surface water resources. However there are no hydrological studies and no account for riparian flow.
3. Biological management is a significant issue. Fish movement is marginally affected by construction of weirs. The small size of the schemes are unlikely to impact fish populations compared with excessive harvests from a growing population. Reductions in shifting cultivation will help conserve biological diversity in upland forests.
4. Air quality and noise is not a significant issue.
5. Waste management was raised as an issue in relation to coffee processing. It was not raised in the project completion report.
6. Risk and hazard management is not a significant issue.
7. Social issues are significant. The population is encouraged to change from traditional systems of shifting cultivation to new technologies and income generating activities which improves life styles.
8. There are environmental issues to be considered in any economic analysis. These relate to the conservation of the uplands, reduced erosion and stream sediments. The cost of water needs to be considered against the benefits derived from irrigation.

Irrigation: Table 4.1 summarises the environmental impact of the irrigation infrastructure installed by the project. The Project Completion Report (PCR) presents data from the Nam Mone watershed which it claims proves the reduction of swidden cultivation with the supply of irrigation. Between 1992-93 and 1995-96 the number of families in swidden across 6 villages fell from 312 to 62 and the number of hectares affected by swidden fell from 123 ha to 29 ha. This is a 77% reduction in area. In three of the six villages the reduction was 100%.

The evaluation team consider that the PCR's claim of reduction in swidden areas needs to be qualified. Published statistics (National Statistical Centre 1992), show that over the

whole province, upland rice cultivation reduced from 21,000 ha in 1992 to 3,485 ha in 1996, a reduction of 83%. A large decline in upland rice occurred in 1993 when the area reduced by 73%, without any increase in irrigated rice areas.

Higher yields have provided some incentive for farmers to use both fertilisers and pesticides on improved varieties. There is a risk that chemicals will be misused as affordability changes. It is imperative that IPM strategies and government regulations are implemented before environmentally damaging pesticide use becomes established.

Fertilisers are being used in small amounts in the irrigation schemes, mainly on the dry season crops. These are generally inorganic compounds of N:P:K. Amounts applied are small and any residual soil nutrient would be used by the following wet season rice crop.

Wild fish movement is marginally affected by the weir construction. The concrete weirs do not provide the same degree of permeability to fish as the brush weirs they replaced. The small nature of the schemes also diminishes the impact over larger catchments. At the Nam Pang site, where a fish breeding wetland was known, the weir was upstream and was reported by farmers and government officers to have no impact on fish populations.

Table 4.1 - Environmental Effects from Irrigation Infrastructure

Potential Negative Impacts	Evaluation Results
Upstream Flooding due to reservoir	In the irrigation schemes constructed under this project, only small weirs were constructed. There were no major dams and so the area of inundation upstream is very small and did not inundate any areas of agricultural production or houses
Siltation	Siltation behind weirs can occur if the catchments are not well vegetated. Generally the catchments were covered in secondary forest. There was some sign of slash and burn cultivation in the catchment but it was less than 5% of the land area. The main offtakes at the weirs had scour gates to remove silt from around the intakes and these appeared to be working well. The canals appeared to be quite clean and were not silting or eroding
Riparian Users	There is no specific requirement under GOL water laws to consider riparian users but there is a requirement to "..ensure protection of the Environment..". The irrigation schemes are near to the junction with other rivers and so it is unlikely that there are any riparian users downstream of the irrigation area who are disadvantaged by the schemes. Farmers within the irrigation area share the water in the dry season so that all receive some water. At Nam Pang each family is allocated 2 rai (0.32 ha) of irrigated land in the dry season.

Soil Erosion	The irrigation areas that were inspected, appeared to be well cultivated and there was no sign of erosion in the fields. The canals were flowing at capacity, with velocities of about 1.0 metres/second but the water was quite clear and erosion of the canals was not occurring. There were some reports by farmers of scour at drop structures but these can be easily remedied with rock or concrete aprons constructed by the farmers as required.
Water Use Conflict	In the dry season particularly, water is a scarce resource and needs to be carefully managed if conflicts are to be avoided. Water Users Groups (WUGs) implemented a system by which farmers shared the limited water resources in the dry season. The irrigation water did not reach the bottom end of the scheme but farmers in this area were given an area of 2 rai (0.32 ha) in the area that did receive water. In the event of a conflict there was a mechanism for conflict resolution.
Downstream Water Quality	In the project areas, there does not seem to be a problem with silt, and as the farmers only use a small amount of pesticides and fertilisers, there will not be high pollution levels downstream.

Upland Agriculture: Improved cash crop opportunities, together with improvement of roads which provide access to markets and other services, have attracted many shifting cultivators to become sedentary farmers producing cash crops. This movement is contributing to the wider government campaign to reduce slash and burn. Technologies associated with fruit tree production, training of farmers, provision of seedlings, and extension support are offering alternatives to slash and burn agriculture in the uplands.

The tree crop technology is aimed at stabilising the soil, decreasing runoff and providing a stable upland production system. However the adoption is tempered by the capacity of the extension services and the availability of improved tree seedling varieties. The technology is new and continued training and farmer support is required. It is unfortunate that the TA was completed before the production systems could be consolidated.

Roads: Marketing of produce is an issue for farmers. Roads encourage settlement and increased land use but if farmers can get crops to market they are more likely to adopt the stable farming systems promoted by the project. All roads in the project were upgrades of roads on existing alignments. The EMP reports[15] that none of the project roads go through proposed protected areas or other areas that are of major ecological significance.

15 Data made available from the International Union for the Conservation of Nature (IUCN).

4.2.3. Community Perceptions

The project was a part of the overall development process by which population in the area was being stabilised and concentrated. However, it targeted only a segment of the population. Population growth, coupled with limited lowland agricultural land, poverty and the lack of alternative income earning opportunities, were perceived by villagers to be placing stress on their surrounding resources. For example, in two villages in the project area, perceptions regarding the decline in fish numbers were related to increasing population and the lack of income earning options for youths who went fishing or shooting to contribute to their families' food supplies and income.

Some farmers perceived the uplands as a resource for the planting of perennial fruit trees mixed with other crops. This is in line with the project's aims of stabilising cultivation of upland areas. The success of these initiatives depends on sufficient capital investment for the purchase of irrigation piping and agricultural inputs, on the availability of suitable improved varieties, and on there being a reliable market with good returns to labour.

4.3. Implementation Assessment

The SAR (World Bank 1989) established ambitious targets which did not recognise the limited capacity of the GOL agencies responsible for the design and implementation of the capital works. The PID (ACIL 1991c) reduced construction targets which were further reduced as the project proceeded. The final outcomes were significantly less than anticipated at appraisal as shown in Table 4.2. Funding of village domestic water supply in the SAR was reduced to provision of technical assistance in the PID and finally dropped from the project when UNICEF included the project area in its funding. Research and training facilities and associated resources and equipment envisaged at appraisal were scaled down. Establishment of a revolving fund providing credit through the government's Tha-Ngon Feed Mill Corporation in the SAR was dropped when the corporation became subject to privatisation. A formal rural credit component was introduced in 1992 (USD 6,000,000), but only USD 880,000 was disbursed through the Agricultural Promotion Bank (APB) before the rural credit component was cancelled. Informal credit was assisted by the TA through establishment of savings groups and rice banks in many project villages.

Table 4.2 Project Targets and Outputs

Sector	SAR	PID	At Completion
Irrigation area in wet season (ha)	5,088	2,500	795
No of irrigation schemes	13	6	3
Road Construction (Km)	741	562	390
Target Villages	150	100	76

4.3.1. Implementation Achievements

Not withstanding the need to reduce the outputs of the project, incomes of a large number of families have been enhanced as a result of the project. Food security has been improved. Improved varieties of cash crops have been identified, demonstrated and adopted. Cash crop opportunities have encouraged shifting cultivators to settle, reducing the pressures of slash and burn practices. Community development has established income generating activities. There is also a greater potential for farmer led extension derived from village development committee's annual plans. Savings groups and rice banks that assist the poor in times of need have been set up. A variety of training has been provided at all levels. The text box below outlines the main achievements.

Achievements of LUADP

- Improved management skills and practices at central, provincial and district levels
- Acceptance of community participation and community organising approach in the provisional and district agricultural service
- Recognition of, and support for, the role of women in agriculture
- Construction of three irrigation systems - Nam Mone, NamPang, Nam Kouang, irrigating 800 ha in the wet season and 250 ha in the dry season
- Establishment and strengthening of Water Users Goups (WUGs) and a Water Users Association (WUA) in each scheme
- Installation of physical infrastructure at Ban Heup (in the north) and Ban Itou (in the south)
- Acceptance of on-farm trials as an adaptive research tool
- Recognition and support for horticulture, especially tree crops
- Introduction of improved genetic material of horticulture crops for testing
- Acceptance of a farmer demand driven extension system, currently orientated towards domestic market opportunities
- Increased adoption of new dry season cropping opportunities in the north
- Extension training program for staff
- Increased area planted to upland tree crops
- Introduction of commercial coffee plantations in the uplands
- Construction of 390 kilometres of roads
- Preparation of a policy document for group lending by the Agriculture Promotion Bank
- Extension and Agriculture Promotion Bank staff trained in lending policy and procedures
- Establishment of 42 savings groups and 60 rice banks

4.3.2. Technical Impact

The PCR records steady progress in development and adoption of more stable land use systems in the uplands. The technologies associated with fruit tree production, training of farmers, provision of seedlings and extension support are offering alternatives to slash and burn practices subject to access to markets. This is a technically sound approach but the impact will require time to be realised as tree crops take time to reach production. A longer term TA may have assisted in consolidating procedures and skills within the extension service and the community.

Three irrigation schemes that have now been completed, Nam Mone, Nam Pang and Nam Kouang appear to be operating quite successfully. The evaluation team visited Nam Mone and Nam Pang schemes where the irrigation system was inspected and detailed discussions were held with members of the Water Users Groups (WUGs). (See Annex A for further details of WUGs.)

The design of the irrigation system was a problem initially. The design of these works had been carried out by the Provincial Irrigation Service (PIS) but were not adequately checked by the TA advisors. The schemes suffered from a number of planning, design and operational deficiencies as evidenced by the overtopping of the earth embankments of Nam Mone and Nam Kouang in August 1995. The scope of the design was underestimated and the supervisory project management of this component of the project did not appreciate the extent of the problems until too late.

It proved necessary to redesign[16] and reconstruct some elements of the irrigation schemes (Montgomery Watson 1998). This reconstruction work for the three schemes was not completed until early in 1998. There has only been a short period of time since completion of the scheme which makes prediction of long-term sustainability difficult.

4.3.3. Economic Impact

The PCR provided a cost benefit analysis of the irrigation development of the three schemes in the north. It suggested that net irrigation benefit would represent about AUD 700 per household. Independent analysis by the evaluation team, and by the World Bank Implementation Completion Report Mission, concur with this estimate. This represents an annual benefit of about AUD 420,000.

16 Carried out by a contractor engaged by the World Bank under IDA credit, not under the AusAID TA.

The PCR analysis concluded that the economic internal rate of return (EIRR) was about 20%. This only takes into account the construction costs to 1995-96 (approximately AUD 1,000,000). While the evaluation team's estimates of areas and rate of adoption differ from the PCR, the resulting EIRR on the basis of initial construction costs, is of the same order. When the costs of remedial works (approximately AUD 700,000) is also taken into account, the EIRR is reduced to 15%.

These estimates do not take into account the costs of the AusAID funded TA. Much of the effort and focus of the Australian TA was directed at the three irrigation schemes in the north. Including this cost in the analysis, at approximately AUD 4,500,000, the EIRR is less than 3%. (It should be noted that these estimates take no account of impacts or costs of the feeder roads constructed under the World Bank credit, or the improvement to Route 13). While many families are better off because of the irrigation works, it must be concluded that the economic impact of the irrigation component, from the point of view of the nation and the point of view of the aid effort, is disappointing.

It is difficult to quantify the economic impact of the remainder of the AusAID input. The PCR estimates that upland crop development, and income generating activities arising from community development, benefited a further 1,500 households in the north. If the benefit represented AUD 300 per household, the EIRR is probably of the order of 10%. The evaluation team feels there are likely flow on effects, particularly from improved varieties of horticultural crops, and the demonstration of income generating activities. These are impacting positively, and will impact further, on many more households. However, the impact of other developments that are independent of the project must also be considered. Development of transport, communication, electrification, schools, water supply, health, and other services, do have positive impacts which cannot be credited to LUADP.

Comparing the economic impact of the upland crop development, and income generating activities, with and without the project, it might be concluded that a very large number of households are benefiting, but the net benefit deriving directly from the project represents a modest amount per household. Much of this benefit, comparing with and without scenarios, would accrue to the introduction of improved varieties of crops.

It can be argued that the community development activities of the project have equipped the beneficiaries with a capacity to take greater advantage, more quickly, of the benefits offered by other developments. In this case, the economic impact of the community development is immeasurable.

The evaluation team could not assess the economic impacts of the project in the south. It is reported in the PCR and the World Bank Aide Memoire, that the provision of improved varieties has had a significant economic impact, particularly with coffee.

4.3.4. Institutional Impact

The AusAID funded TA implemented an extensive program of training including technical training, training in community organisation, workshops, seminars, study tours, farmer field days and exchanges, and on the job training. Training was provided at all levels - policy makers in the Ministry of Agriculture and Forestry (MAF), provincial and district government staff, village leaders, village development committees, Lao Women's Union (LWU) members, WUGs and farmers.

In the north, there appear to be a few excellent people who received training under the project. With completion of the project, however, the institutional capacity to continue research and extension activities initiated by the project would seem to be limited. The evaluation team is not in a position to make any assessment of the outcome for institutional capacity of research and extension in the south.

The project did recognise the implications of the limited human and financial resources of government for research and extension, and placed emphasis on developing community strengths. Within the villages, local institutional improvements appear to have been achieved with the formation of development committees, income generating activity groups, savings groups, agricultural groups, rice banks and WUGs.

The PCR concludes that central and provincial level support services have been greatly strengthened and are now providing effective credit, adaptive (on-farm) research and extension services in close collaboration with target communities. Observation by the evaluation team, at least in the north, agrees there has been some improvement, but considers the PCR may be overstating the reality.

4.3.5. Social and Cultural Impact

Technology Transfer. The project adopted a community development approach and worked with the provincial and district extension agency to gain acceptance of community participation of village groups in planning and implementation. This was viewed as an effective way of transferring technology given very limited government resources and as a way of encouraging community 'ownership' of project activities.

Village development committees and WUGs were established for planning, coordinating, and overseeing project activities. Production groups, including agricultural, weaving and livestock raising groups, were formed and given training. Rice banks and savings groups were also formed and training given in their operation and management with injections of rice for the rice banks. Leaders of production groups were elected by group members, received training in relevant skills, and then worked as voluntary village extension workers. The project instituted mechanisms to promote the transfer of information and resources from these individuals to other members of the groups.

The villagers, both men and women, provided labour to assist with the construction of the weirs. This provided valuable team building skills and knowledge of construction techniques.

Project Impact and Adoption. The project recognised the need for increased production of both rice and cash crops. It also recognised the need to encourage alternative income generating activities to increase household economies, especially during the dry season. People interviewed were generally enthusiastic about the greater opportunities and changes that the project had brought to their lives. One couple had named their baby Phattana, meaning 'development', because he was born in 1993 'when development came to the village'. Some dissatisfaction was expressed by a few villagers who were unhappy about access to water and the disregard of their concerns in the planning and building of the irrigation system.

While irrigation has allowed a second rice crop to be grown in some parts of the lowland area, the main impact felt by villagers interviewed was stated to be in the greater range, quantity and quality of cash crops grown and the livestock produced which improved incomes as well as diet. In one village, villagers reported eating more eggs and chicken meat due to the activities of the poultry raising group. In another two villages, a wider range of foods was reported as being eaten as a direct result of the project's introduction of new and improved varieties.

A sense of ownership of the irrigation scheme by the farmers is emerging. The evaluation team, when meeting WUGs, was told that, when the government owned and maintained the irrigation schemes, if a water buffalo got into the canals, no-one would get it out as it was not considered their problem. Now the farmers own the system, they would get the buffalo out of the canal before it could do damage which they would have to pay for.

Rice banks in the villages visited by the evaluation team were operating and were perceived by villagers as valuable for ensuring families did not go hungry. In some villages, poorer families were given priority in borrowing from the rice bank. Villagers who had genuine reasons for failure to repay, such as poor harvest or illness, were viewed sympathetically by the rice bank management committee. In one village, rice which had accumulated in the rice bank had been sold during the previous year when prices were high and the money directed towards the building of a primary school. There was still enough in hand to lend seven tonnes of rice in the current year.

While irrigation water supplies have improved, there is still not enough water to supply all households in the dry season. Fields were reallocated to allow most households access to dry season land adjacent to natural streams or irrigation canals where they could grow crops such as peanuts, maize, vegetables and water melons. In some villages not all households were included. For example, in one village in the Nam Mone irrigation scheme, 46 of the 96 families did not obtain a share of the dry season water supplies. These people survived by finding labouring jobs, by weaving cloth for the market and by

raising livestock. Whether this was because of limited availability of land, or the preference of these families to seek alternative income earning opportunities, was not able to be determined in this evaluation.

Some group failures were reported. These included savings groups where the interest rate had been too low to attract deposits and chicken raising groups which had lost their stock to disease even though the members had been trained in vaccination. Cash crop production groups were also said to be difficult to maintain. Competition between farmers to be the first to bring their produce to the market meant there was a disincentive to cooperate. This was not a production failure, but a failure to maintain the social organisation.

Savings groups were strong during the early period of the project and were said to have contributed loans to enable production groups to develop.[17] However, in the villages visited they were not functioning well. It is possible that in some villages access to bank credit was beginning to take over some of the role formerly played by savings groups.[18] Access to markets was also a vital factor in production group success.

The villages are composed of mixed ethnic groups with the large majority of people in the northern project area being lowland Lao Loum. In the south, there is a greater proportion of ethnic minorities. In the short time available for this evaluation it was not possible to obtain information concerning any differential participation or impact on these minority groups.

4.3.6. Impact on Women

The Lao Loum are the dominant ethnic group in the northern project area. They have a tendency to a matrilineal pattern of land ownership (Schenk-Sandbergen and Choulamany-Khamphoui 1995). Traditionally, Lao Loum women have had a powerful access to and control over agricultural resources. They contribute substantially to family labour and decision-making in agricultural production.

In modernised and legalised WUGs and WUAs, such as that formed under the project, Lao Loum women's participation and control over the use of 'their' land (Schenk-Sandbergen and Choulamany-Khamphoui 1995) appears to have been reduced. Women provide labour for irrigation system maintenance and through their income earning work they contribute to the payment of water user fees. However, men form the large proportion of WUG and WUA membership.

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17 Interview former project manager, Vientiane, 21 September 1998.

18 The Deputy Director of the Agricultural Promotion Bank commented on the relatively large numbers of group loans in the project area.

Village development committees, like WUGs, are perceived as being in the official public domain and therefore the province of men. Usually there is only one woman representative out of about 5 members. This woman is often the Lao Women's Union (LUA) representative.

The project complied with AusAID gender guidelines and women's participation in project activities was encouraged although there was limited success in promoting their participation in some decision making bodies. A gender analysis report was written in 1992 (International Development Support Services 1992).

The appointment and work of local gender advisers appears to have been very successful in increasing women's involvement in production groups, such as agriculture, weaving and small livestock raising. A number of women who led successful groups exhibited outstanding leadership, management and marketing skills (see Annex B). Yearly project training figures indicate an increase in women's participation in the north from 10% to 60% and 0% to 20% in the south (ACIL 1996).

In the north, a workshop was held by the project to encourage women's participation in production groups. While this was very useful in raising women's consciousness, involvement and leadership, in at least one case, it caused conflict between a Hmong[19] woman and her husband who did not want her to join a group.

Women interviewed were enthusiastic about the additional income they were earning. They said that while their work had increased through project activities, the improved production and income was worth the extra labour. However, this was being off-set to some extent by inflation and subsequent rapidly increasing costs.

Credit was sometimes required for the consolidation of group activities. In some villages, the project organised for the Agricultural Promotion Bank to meet with women. However, they said they were 'frightened' of the formal processes involved. Contracts with the bank were usually signed by their husbands even when loans were for women's activities. This may also have been part of bank staff assumptions and procedures in which household heads were expected to sign.

Improved domestic water supplies[20] relieve women and children of the drudgery of carrying water. Women living close to irrigation canals appreciated the improved water supply, although those more distant received no benefit.

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19 Hmong are traditionally patrilineal.

20 Domestic water supply was part of the original design but was subsequently passed over to UNICEF.

4.3.7. Performance of Management

The project management was compromised particularly with regard to roles and responsibilities for the implementation of capital works specified within the World Bank Staff Appraisal Report. This led to some misunderstandings over the design and supervision of infrastructure construction. It was not helped by the continued use of two design documents, the SAR used by the World Bank and the PID used by AusAID. The SAR emphasised the implementation of the loan financed activities while the PID emphasised the community development processes required for irrigation operation and maintenance and for technology transfer.

Disruption in implementation was unavoidable as a result of security problems. This stopped the momentum in the early years and caused significant changes in personnel when those with the corporate knowledge were unavailable when the project remobilised. During the course of the project, there was a high turnover of advisers in some key areas such as research and irrigation. These areas appear to have been affected by inadequacies in technical assistance.

Changes in institutional arrangements within the counterpart agency also affected performance of management. In the first three years, the central Department of Agricultural Extension was responsible for the project. In the later years responsibility was given to the provinces. This required realignment with a new counterpart agency which previously had little to do with the project.

By the last year of the project it would seem that most of the management constraints had been settled. Implementation coordination arrangements and general project management was reported to have improved dramatically.

The PID (ACIL 1991c) called for the setting up and training of WUGs. This was undertaken as part of the Australian TA initially and then continued under a separate agreement between the World Bank and GOL (Montgomery Watson 1998).

4.3.8. Cost Effectiveness

The incomes of a large number of families have been enhanced as a result of the project. The costs, however, have been high, and it is not clear how much might have been achieved without the project.

Australian assistance represented about AUD 9,000,000, of which about half was focused on the three irrigation schemes, and on the villages in the irrigation schemes. The economic return to the irrigation development costs, and the TA associated with the irrigation development, is estimated to be about 3%. It is difficult to conclude that the assistance given to irrigation development has been cost effective.

With respect to stabilisation of shifting cultivation, and reduction of slash and burn agriculture, it has been suggested to the evaluation team that improvement of roads and provision of good access to markets has been the major factor encouraging shifting cultivators to settle. Where there are good roads, they no longer need to move about to eke their subsistence. Access to markets provides income generating opportunities by which they can live, and abiding in one place allows access to schools and services that are sought after. The contribution of the project has been the provision and demonstration of new varieties of cash crops, and training associated with management of tree crops, that can be grown within reach of the roads.

Variety trials, and selection of improved varieties, appears to have been a cost effective component of the project, both with the Australian TA cash crops in the north, and the French TA coffee improvement in the south.

Lowland farmers, with and without irrigation, and cultivators formerly dependent on slash and burn, have benefited to varying degrees. The rate and level of adoption is dependent on the research extension linkage and processes. The project assisted in this regard through intensive community development activities.

It is difficult to separate precisely how much of the AusAID funded activities are directly allocatable to community development, and it is difficult to quantify the extent of the impact. However, a qualitative assessment by the evaluation team concludes that this component has been cost effective.

With regard to agricultural development, the provision of improved varieties does appear to have been cost effective. Assistance to community development also has potential to be cost effective where communities are enabled to identify options, and empowered to make and act on decisions that will improve their well-being.

4.4. Sustainability of Outputs

The Hin Heup Research and Extension Training Centre, in Vientiane province, had structures funded by the IDA credit, and up to 1996 it was supported by AusAID funded TA. The structures included an administration building, training facilities, nursery facilities, residences, roads and water supply. For the last two years the research centre has been funded with 80% from the project credit and 20% from provincial funds. With completion of the project, on-farm trial work, and training activities have diminished. Without additional provincial funds, the Hin Heup Centre will very likely fall into disuse.

The maintenance of nurseries and mother tree gardens constructed under IDA finance is dependent upon government funding. This places an element of uncertainty on the sustainability of the infrastructure. Staff appear to be well trained and are continuing to propagate fruit tree seedlings for distribution to farmers. Extension Agents continue to train and work with farmers around Hin Heup station. Their continued performance will be dependent on local funding.

The adoption of tree crops to stabilise the upland farming systems depends on the research and extension support for supply of seedlings, evaluation of improved varieties and ongoing technical advice. Tree crop cultivation is a long term exercise and farmer training needs to be maintained over the life of the crop. It is not a technology which is familiar to traditional farmers, especially the husbandry of the improved varieties. It is unfortunate that the project was completed before research and extension services were consolidated. They will not be sustainable without further technical assistance and training.

A number of the community groups established by the project remain intact and working. They would benefit from continued assistance as they work through issues in their early years of operation. This is a role for the government extension service but human resource and financial constraints limit the amount of contact. If the government cannot maintain some extension support, the sustainability will rest with the farmer producer/trader relationship. In this event, the commercial incentive for both parties is the likely assurance of sustainability.

With regard to feeder roads constructed under the project, there are doubts about the capacity of the government to ensure sufficient recurrent funding for maintenance (World Bank 1998).

The two irrigation areas inspected, met the criteria for sustainability but it must be said that the system has only been fully functional for less than one year and so it remains to be seen if any long-term problems emerge. At the time of the evaluation, an area of concern is the capacity of government, due to funding constraints, to provide support to the scheme should there be any problems.

Government decentralization policy supports the continuation of the project's participatory community development approach which was found to provide an effective means of delivery given limited resources.

Formal credit availability has been an important factor in the expansion and sustainability of a number of community production groups. These groups often have skilled leaders with entrepreneurial skills and the groups' economic bases appear to be increasing. However, as these leaders become older, new capable leaders will need to be found and the skills of group management and marketing transferred. Competition from imported manufactured cloth available in Vientiane markets which is finding its way even into smaller local markets may affect the demand for hand woven cloth in the future, especially in the face of rising prices for the thread used in the weaving.

Some rice banks appear to be operating well and are likely to be sustainable if there are no consecutive crop failures.

Difficulty with obtaining good quality seed is an important factor in the ability of villagers to continue cash cropping and the cultivation of improved rice varieties. Market

access is also vital for the movement from subsistence to market production. Villagers in the Nam Mone and Nam Pang schemes had good market access as the main highway passed close by. However, production for the market in the Nam Kouang scheme was very limited because the area was inaccessible for part of the year (ACIL 1996).

As population grows through natural increase and through the voluntary and spontaneous resettlement of upland peoples, there will be greater pressure placed on the limited amount of lowland agricultural land available. A range of alternative income earning opportunities will be needed to support this denser population.

4.5. Lessons Learned

There was no environmental impact analysis at project design stage. The environmental guidelines of AusAID and the World Bank were just emerging at the design stage and were untested. The evaluation team identified there were environmental issues associated with water management, migration of fish and use of agricultural chemicals which have potential impacts but had not been addressed. It is unclear whether the responsibilities to assess the environmental effects rested with AusAID or the World Bank. The lesson is that AusAID should not assume that its partner in a parallel (or co-) financing arrangement will carry out an environmental assessment to the same level of detail that is required under Australian law.

The construction of permanent weirs has changed flow patterns and reduced flows downstream as there are no riparian release provisions. However, the three rivers that have been dammed are near the junctions with other tributaries and so the effects on downstream users are minimal. In any future irrigation project, riparian releases need to be considered. This can best be accomplished by requiring a Catchment Management Plan which will consider such issues as siltation upstream of the weir, catchment land use, fauna and flora impacts, and water quality effects

With regard to agricultural development, the demonstration of improved varieties appears to be an activity with high benefit. Farmers appreciated the greater range, quantity, and quality of cash crops that they could grow.

The withdrawal of AusAID assistance before consolidation of some sectors of the project, such as research, extension and community assistance has left a partial vacuum which has not been filled by the local agency. The WUGs seem to be quite stable and functioning on their own but other groups would have benefited from continued AusAID involvement to ensure sustainability and to protect AusAID's investment. In some sectors, it would have been desirable to have continued the assistance for some years after the infrastructure had been completed. The lesson is that it may be appropriate to continue with training and support for some years after the infrastructure is completed.

It can be argued that the community development activities of the project have equipped the beneficiaries with a capacity to take greater advantage, more quickly, of the benefits offered by other developments. In this case, the economic impact of the community development is immeasurable. Community development, in its own right can, therefore, be a very worthwhile activity. The project derived considerable benefit from a gender aware approach to community development. Sustained efforts needed to be given to the orientation of implementing agencies to this approach and sufficient lead time needs to be allowed for it to gain acceptance.

The irrigation infrastructure that was inspected, appeared to be functioning satisfactorily. However, as with any infrastructure, there is a need for on-going maintenance. This maintenance can be provided by farmers through the WUGs but if major repairs or upgrading are required, the cost may be beyond the farmers to fund. The Department of Irrigation (DOI) said that they will assist for major repairs but whether in practice they will have sufficient funds is doubtful. The lesson to be learned is to ensure that the local agency responsible for the infrastructure, has sufficient funds to carry out maintenance if required.

There were a number of difficulties associated with the parallel financing arrangements with the World Bank and two design documents. This resulted in difficulties for the AusAID TA team in understanding their roles and responsibilities. There is a need for AusAID to clearly formulate the roles of the TA advisors in advance of mobilisation and to agree between donors on the scope of work.

There were some problems with the baseline hydrological data, survey and irrigation design. Mistakes made during initial design were not identified which resulted in the World Bank having to arrange for substantial redesign and reconstruction after AusAID had finished their involvement. It is important that data is available for design and that experienced staff are assigned to the field who can assess this data. There should also be an adequate system of technical back-up and quality assurance.

4.6. Performance Ratings for the Activity Monitoring Brief

The Activity Ratings for the Activity Monitoring Brief, as part of the Activity Management System are:

		Rating
Ratings against Objectives	Development	3
	Maintenance	2
Rating of Appropriateness of Objectives		3
Overall Performance	Development	3
	Maintenance	2
	Training	4

Other Indicators	Contractor Management Performance	3
	Partner Agency Inputs	2
	Financial Sustainability	3
	Institutional Sustainability	3
	Procurement Progress	3
	Technical Aspects	3
	Environmental Aspects	4
	Social Aspects	4
	Gender	4
	Population	97

Ratings are according to the grades specified for the Activity Monitoring Brief. 5 is a top score; 2 is a low score; 97 is not applicable

5. CONCLUSIONS AND LESSONS LEARNED

The conclusions and lessons learned are presented as an overview of the cluster derived from the literature review, field research and personal experience of the evaluation team. All evaluated projects had a substantial focus on rice production. Detailed consideration has been given to environmental issues. The sustainability and development impacts of the projects were assessed within the overall development context in which they were designed and implemented.

5.1. The Environmental Assessment of the Projects

5.1.1. The Policy Environment.

The evaluation team used the AusAID environmental screening guidelines of 1989 to conclude that all projects had a neutral or positive impact on the environment but this was not in compliance with any policy direction. AusAID's first guidelines were published in 1989 and those of the World Bank shortly after in 1991. Neither set of guidelines had been tested in the field and the project suffered because of the gap between theory and application. Both AusAID and the World Bank now have rigorous procedures for assessing environmental impact.

AusAID made a partial attempt to address the policy vacuum in the LUADP when it required an Environmental Management Plan to ensure the project conformed with obligations under the Environment Protection (Impact of Proposals) Act 1974. This was the only documentation in the cluster which was specifically directed at addressing AusAID's environmental obligations. However it appeared to have no status with the project partners. The World Bank guidelines were published in 1991, two years after the Staff Appraisal Report for the project. There does not appear to be any project documentation which attempts to draw the project into line with the Bank's environmental guidelines after 1991. The environmental management plan identified a lack of any formal documentation on the World Bank's position in relation to the environmental requirements.

The Lesson: AusAID must ensure that its projects are consistent with Australian legislation and thus, must ensure that agreements with multilateral partners and development banks take account of AusAID's legislative obligations.

In the absence of policy and guidelines all the projects still performed well in the evaluation team's environmental assessment. The reasons relate to the environmental consciousness and professional integrity of the field personnel.

The evaluation team noted that IRRI gave no environmental guidelines when the projects were implemented.[21] However the environmental assessment of its research

21 IRRI now has an environment (and gender) policy which can be found in their Strategic Plan: IRRI Toward 2020. Chapter 3. - "Environmental quality and sustainable development" and "Efficiency and equity"

efforts in CIAP and Vietnam-IRRI indicates that IRRI is making positive contributions to ecologically sustainable development through the varietal improvement, IPM and INM. Globally, IRRI has a plethora of research programs ranging from germplasm collection to pest management which demonstrate the contribution it makes to maintaining sustainable management of rice ecosystems. The question for AusAID is whether the policy environment within IRRI is adequate for its own requirement under the Act. In future projects, AusAID may wish to consider signing an MOU with IRRI which would satisfy compliance under the Act.

The Lesson: While IRRI's programs are largely positive in their environmental impact AusAID needs to question whether the environmental policy is sufficient for AusAID to meet its obligations under Australian legislation. If not AusAID needs to negotiate a MOU to cover its funding agreements.

Despite AusAID's strong commitment to, and a legislative requirement for the advancement of environmental amelioration, the evaluation team observed a singular lack of awareness among project participants of AusAID's position on the environment (and disadvantaged groups) by the funding recipients. It is important to stress that there was still a strong commitment to the environment and to disadvantaged groups within the projects despite the lack of guidance from AusAID.

The Lesson: Project design should include responsibility for AusAID to provide policy information to project participants on the environment, gender and disadvantaged groups, and a mechanism for monitoring compliance.

5.1.2. Monitoring Impacts.

Assessing environmental impacts in all projects in the cluster was frustrated by a lack of data and reporting. Hence the evaluation relies on "anecdotal evidence" for a large part. Environmental issues should have been monitored for Vietnam-IRRI and reported in annual reports. Environmental impacts should have been monitored for LUADP through the annual work plans. These reports and plans could not be found. There is an element of luck in that there were no real environmental impacts to be addressed.

CIAP did attempt to collect detailed data on biodiversity in the rice fields, as have a number of international NGOs in Cambodia. CIAP's IPM studies were used to conclude that no negative impact on biodiversity occurred from CIAP technologies. Vietnam-IRRI did monitor water pollution downstream from the cultivation of acid sulphate soils in the Mekong Delta, bringing the impacts to the attention of the government in Hanoi. This was a research exercise and concluded when the results were obtained. Continued monitoring could not be sustained. The experience indicates that to collect useful data requires staff, time, effort and expense.

The Lesson: If AusAID wants environmental impacts of agricultural projects monitored, it may have to fund that monitoring. Even with such support the activities may not be continued after the withdrawal of assistance. However it may be possible to motivate communities into monitoring their environment in their own interest. To this end projects should include community training in basic environmental monitoring techniques.

5.1.3. Agricultural Technology.

All projects in the cluster sought to increase agriculture production by researching and applying technology tested in farmer fields. The evaluation concluded that there were no adverse environmental impacts from the agricultural technologies introduced by the projects in the cluster. In fact the projects showed positive impacts. For the IRRI managed projects in Cambodia and Vietnam, germplasm collections contributed to the conservation of biodiversity; varietal improvement provided higher yielding varieties more resistant to pests and disease, thus reducing the need for agricultural chemicals; integrated nutrient management/farming systems established a balance between cropping systems (incorporating green manures and crop rotations), organic and inorganic fertilisers; integrated pest management demonstrated the benefits of a management system which uses the natural enemies of pests and disease as an alternative to applications of agricultural chemicals.

For the World Bank parallel financed project in Laos, fruit production technology provided a stable farming, environmentally sound system of land use in the uplands as an alternative to shifting cultivations which were unsustainable as population pressures grew, irrigation infrastructure offered opportunities to introduce dry season cropping technologies which improved farm incomes, removing the necessity to slash and burn uplands to supplement rainfed rice production in the lowlands, community participation processes were used to foster water user groups, agricultural production groups, income generating activity groups, savings groups and rice banks. These improved the support and security for small scale farming practices. The LUADP groups provided a vehicle on which to deliver new technologies such as integrated pest management, although AusAID funding ceased before the technologies could be consolidated. This has left the farmers with the water resources but without a full understanding of the environmental impacts which can occur if they mismanage the inputs as they seek to utilise the water.

While the projects have introduced agricultural technology in an environmentally responsible manner, there are concerns regarding new technology which need to be raised. There are indications that intensification technology is leading to abuse of pesticides and eutrophication of streams, especially in the Red River and Mekong River Deltas. There is also a phenomenon, referred to as yield decline, which is described as a need for ever increasing levels of fertiliser to maintain the same yield or even a yield reduction. This is unexplained and not exclusive to Vietnam and is the subject of a global

research effort. While Vietnam may require a rehabilitation effort to recover from misuse, Cambodia and Laos offer opportunities for preventative measures. Fortunately AusAID continues to fund CIAP, allowing its IPM and INM strategies to be researched and transferred across Cambodia. In Laos the AusAID funding ceased before the technology was sustainable.

The Lesson: When new agricultural technologies are introduced there should be an awareness of impacts beyond the scope and duration of the project and a preparedness to monitor impacts and research new and emerging issues so that corrective measures can be taken before the impacts become excessive.

5.1.4. Resource Use

Farming populations use the resources around them to supplement their agricultural production - to provide for their own subsistence needs as well as contributing to cash incomes. Wild foods, such as birds, fish, crustaceans, insects and plants such as ferns, berries and mushrooms are an important element of their diets and provide a safety net and source of food in times of scarcity. In both Cambodia and Laos, farmers noted declining numbers of some species of animals and plants. They related this trend to the pressure of increasing population and to the intensive harvesting of wild food for sale. In Laos, people are being encouraged to become sedentary farmers and development is having the effect of concentrating population. The lack of opportunity for young people to find income earning opportunities through which they could contribute to their households' economies was noted as an important element in increased harvesting of wild foods for home consumption and sale.

The Lesson: Increasing population, poverty and lack of income earning opportunities are leading to greater pressure on wild resources to supplement farm incomes and for food. Projects need to offer a range of options of alternative income earning opportunities which are available to all ages.

Development agencies such as AusAID need to be aware of the impacts of change on the natural resources. Where pressures of development are leading to a decline in natural resources, development assistance projects must offer solutions which relieve the pressure.

5.2. The Assessment of Performance of the Projects

The achievements of the projects in the cluster were evaluated as follows:

- CIAP has made significant progress in the development of Cambodia's research capacity and contributed to the rice production and productivity of the nation. In Phase III of the project, rice production increased by more than 1,200,000 t/year and more than 500,000 t/year is attributed to varieties and other technology introduced by CIAP. The project has trained 10 PhD, 3 MSc, 7 research fellows

and over 1,000 participants in short courses. It has published numerous technical papers and reports derived from its research.

- The Vietnam-IRRI Project was difficult to evaluate because of a lack of reporting and difficulty in identifying the AusAID funded activities within a larger program involving other donors. Rice research in Vietnam has contributed greatly to improvements in productivity. Yields of improved varieties are now double that of traditional varieties, reaching 6 t/ha. Total national production is nearly three times that of 20 years ago. Adoption of IRRI varieties is widespread (70%-80%) across the lowlands. The project provided non-degree and on the job training for 112 participants. The Vietnamese rice research community appears competent, enthusiastic and well mentored by IRRI.
- LUADP started with ambitious targets which failed to recognise the limited implementation capacity of the beneficiaries. Targets had to be reduced after implementation commenced. Three irrigation schemes were built covering 795 ha, 390 km of feeder road was constructed, extension activities covered 30 villages in the north of Laos and 46 villages in the south, small scale research and training facilities were completed and informal credit arrangements were established through savings groups and rice banks. A major achievement was the adoption of a community development approach which is now part of the decentralisation policy of Laos.

The Lesson: Project design targets need to be realistic in terms of expected outputs and duration. This can be accomplished by ensuring the targets are established with due consideration given to the implementation capacity of the beneficiaries.

5.2.1. Design and Management.

There was considerable variation in the design and management of the projects in the cluster. CIAP was seen as well designed, managed and reported. It has enjoyed long term technical and management assistance from Australian personnel experienced in AusAID's reporting requirements. It is now in its fourth phase of implementation and making satisfactory progress against a realistic design.

Vietnam-IRRI was a small project within a larger program. Its design was simple and achievable but lack of a permanent project coordinator was reflected in poor reporting which made it difficult for the evaluation team to track the project outcomes. The design itself indicated that IRRI was not familiar with AusAID requirements. IRRI and the Government of Vietnam have systems which are different from those of AusAID. It would seem they used AusAID funding to good effect within the larger program but failed to separate and report achievements from AusAID's contribution. There are no indications that AusAID tried to correct this over the 10 year term of the project and therefore the managers continued to ignore AusAID's reporting requirements. The lack of reporting of environmental issues required in the design was significant for AusAID.

The Lessons:

1. When Australian funds are managed by institutions such as IRRI, it must be realised that their design and management procedures may not conform to AusAID requirements. If AusAID requires compliance with its operations guidelines, they must be specified in the funding agreement and may require additional funding to provide the institution with the resources and/or training to comply.
2. IRRI has proved to be an effective and environmentally responsible partner for AusAID.

LUADP was a parallel financed project with the World Bank. As such, it was based on the Bank's Staff Appraisal Report (SAR) of 1989 which was retained by the Bank as its official design. In 1991, the managing agent produced a Project Implementation Document (PID) for AusAID which became the basis for all AusAID funding. The PID differed from the SAR in that it focused on technical assistance and community development, while the SAR focused on physical inputs and disbursements. The effectiveness of the technical assistance was compromised from the outset in having two designs to contend with. This was compounded by a lack of definition of roles and responsibilities for the technical assistance which led to some misunderstandings, particularly over the supervision of design and construction of infrastructure. Other factors which compromised the effectiveness of the project were disruption in implementation as a result of security problems, lack of continuity in technical advisers and changes in institutional arrangements within the counterpart agency.

The Lessons:

1. In parallel financing projects with the World Bank, AusAID must ensure there is clarification of roles and responsibilities between all parties, within an agreed project framework.
2. There is a need to ensure that staff nominated for AusAID projects are available when required and have the necessary skills and experience.
3. The failure of the partner country to meet its commitment in providing suitable counterparts, facilities and budget, can compromise achievement of project effectiveness.

5.2.2. Intellectual Property.

Intellectual property (IP) and biotechnology are related issues that have emerged in the IRRI projects where new varieties were being developed. The issues are discussed in more detail in Annex C. Intellectual property did not appear to be an issue for the cluster projects and those managed by IRRI are possibly protected within under the CGIAR policies which aim to protect the interests of the indigenous owner. However any project with a breeding or biotechnology component needs to include procedures for protecting the IP rights of the indigenous population. This requires new management expertise to ensure that the accruing benefits are captured for community advancement, and the inherent risks are not translated into community penalties.

The Lesson:

1. The management of Intellectual Property must be considered in the design of agricultural research projects particularly those concerned with plant/animal breeding.
2. AusAID will require policy and management expertise to protect the IP rights of indigenous owners.
3. Biotechnological processes developed within AusAID projects need to be protected and decisions made on the ownership of the technology and the distribution of benefits.

5.2.3. Use of Research Data.

Research projects, particularly breeding programs, generate large amounts of data, which has considerable value that transcends the immediate application. These may include an evaluation of the efficacy of the breeding program and information that may be of value to the current program or one located in another region or country.

CGIAR centres have developed a database platform that can be customised for a number of crop species including rice and wheat. These databases (International Crop Information Systems or ICIS) are currently well advanced and are located on the world wide web. AusAID need to ensure that its research projects such as CIAP are lodging their data in ICIS. Also, the scientists should make full use of information generated in other rice breeding programs.

The Lesson: The capture of the data generated in research programs in a form that facilitates electronic access to others should be considered at the design stage. If this is not specified there is a danger that research results will be lost or confined within a small knowledge domain.

5.2.4. Cost Effectiveness of Training.

Each of the projects in the cluster had a significant training component. However, the emphasis in each was different.

- In Cambodia, training was provided to research scientists, and to extension agents, partly with IRRI resources, and partly by advisers funded by AusAID. On the job experience was provided in adaptive research with supervision from advisers funded by AusAID. Persons trained were mainly from government, but not from specialised research institutes. Attempts are being made to establish an institute and mechanisms to sustain the adaptive research and extension efforts, with nation wide focus. A significant impact has been made on national rice productivity, and to research-extension linkage, at a reasonable cost to Australia.

- In the Vietnam-IRRI Project, training was provided to research scientists. The training was by IRRI, and on the job research experience was provided through collaboration with international scientists from IRRI, at very little cost to AusAID. The Vietnamese scientists were from established research institutions where they continue their research with nation wide focus. A significant impact has been made on rice research and productivity, at low cost to Australia.
- In Laos, training was provided to extension agents and communities, in a limited geographical area, with adviser resources fully funded by AusAID. Research and training facilities, and extension community linkages were put in place, but these facilities and linkages may not be sufficiently well established to be maintained. The aid provided a significant impact over a small area at a relatively high cost to Australia.

The Lesson: Funding of training and experience in research, and strengthening research extension linkages on a nation wide basis, can be cost effective. Strengthening extension community linkages, and training communities in a small area, with consultant advisers fully funded by Australia is relatively expensive. Training of communities can be effective, but may be better implemented through NGOs.

5.2.5. Research Extension Linkages.

All projects in the cluster had a research component and in CIAP and Vietnam-IRRI research was dominant. In the assessment of performance of research, the evaluation team saw the farmer adoption of new technology as the indicator rather than the research result per se. This required an examination of the research extension linkage.

The research extension linkage was addressed in different ways in each project in the cluster. Both CIAP and Vietnam-IRRI started before their countries had a formal extension service. CIAP, with a greater physical presence than Vietnam-IRRI, established its extension network with NGOs. Vietnam-IRRI left the research extension linkages to the collaborating institutions which conducted their own extension activities. These relationships continue although both Cambodia and Vietnam now have a formal extension service. In Cambodia, CIAP operates as a subject matter specialist providing technical information to both the formal and informal extension services. The evaluation concluded that this is an appropriate research extension relationship. In Vietnam, the research extension linkages were not adequately defined in the Vietnam-IRRI Project despite it being required in the design. The research institutions continue to run their own extension agenda, in some cases because of lack of communication between research and extension and in other cases to cover areas that are not served by the Department of Agriculture and Forestry Extension. The evaluation concluded that the research extension relationship continues to require definition.

The Lesson: Project designs must explain how the research extension linkages will ensure research results are available for farmer adoption. This does not imply that projects must include both research and extension but rather identify what the constraints may be to having research results adopted. This may highlight the need for separate assistance to extension services.

LUADP was designed with both a research and extension component. However the research component was weakened by turnover of technical assistance. Technical assistance to the extension service was much stronger and the project made considerable advances in developing extension mechanisms which resulted in a farmer driven extension approach based around participatory learning and action. Project research was largely on-farm-trials with technology adapted from other national and international research. The community organisations established by the project such as water user groups, agriculture production groups, non-agriculture income generating groups, savings groups and rice banks offered excellent forums to develop an interactive extension service between research, extension, the private sector and the farmer. They also offered the best mechanism to establish a gender balance and environmental awareness in the extension service. Unfortunately the AusAID funding ceased before the project could properly establish the process and ensure the infrastructure was in place. Although extension and research staff were familiar with the concept, there remains a question over its sustainability. For a relatively small additional investment the benefits may have been secured against the much larger amount already invested.

The Lesson: Participatory processes required by a farmer driven extension approach offer excellent opportunities to apply gender and environmental guidelines. However they take time to develop an experience in the participants which can ensure sustainability. AusAID needs to be aware of the time requirement and consider funding and duration to suit the technical and social realities of the activity.

The value of applied agricultural research is that products are produced that, in the hands of farmers, will advance policy objectives. The products from the projects evaluated included information and varieties. It was evident that no process had been considered to allow farmers unhindered access to these products in the design phase. It must be stressed that project officers were aware of the need for technology transfer and significant progress had been made. Information was efficiently communicated to farmers via the NGO system in Cambodia. The distribution of seed of new varieties to farmers was significantly impeded by the lack of an efficient seed multiplication and distribution scheme

The Lesson: The project design must consider how technology transfer will occur. This may include linkage with the private sector for seed multiplication and distribution.

5.2.6. Gender Awareness.

Although gender was addressed in some way by all projects in the cluster, it was treated as a discrete issue and tended to be left to whoever was responsible for 'gender' or 'women's activities'. This meant that there was no overall attention to gender issues throughout project activities. Gender activities need to go beyond data collection and analysis of women's roles at farm level. The application of how this information should be applied in research activities, and the importance of gender issues and how they should be mainstreamed within project processes and activities, need to be understood and constantly applied in project design and implementation.

The Lesson: In order to systematically address gender issues, all project participants, including those from the implementing agency, need to be aware of, and oriented to, gender concerns and know how they can practically address these in their work.

5.2.7. Women as Decision Makers.

AusAID gender guidelines prior to 1992 focused on women's participation in projects and the assessment of impacts on them (ACB 15: Women in Development – Activity Analysis 1988). A 1992 policy revision shifted the approach to one of Gender and Development and emphasised the importance of promoting women as decision-makers at all levels.

While efforts had been made to include women as participants in many project activities, their role in public decision making institutions and organisations related to project activities was less well able to be addressed. This was related to the view that men are the heads of household, the decision makers and the representatives of their families in public.

The Lesson: Projects need to develop strategies to promote women's membership of formal decision making organisations. Membership rules and regulations need to be examined and, if necessary, altered to enable more women to be involved. Existing members need to be consulted and encouraged to develop their own strategies to invite and encourage women to join. Women themselves need to know that their involvement is important.

The contribution of women as farmers in the project areas was considerable. The proportion and importance of women in agriculture, however, was not reflected in women entering agricultural institutions and being employed in decision making positions in government agricultural services and in the numbers of women scientists. The extent to which training and career advancement opportunities provided by CIAP and Vietnam-IRRI projects were taken up by women was often limited by the number of women agricultural professionals.

The Lesson: In order to obtain a greater number of qualified professional women in important agricultural decision making bodies, more effort needs to be placed on encouraging women to enter agricultural education.

5.2.8. Sustainability.

The development of an institutional framework for research and extension takes time. Project duration and funding must take account of the to develop an experience in the participants to ensure sustainability. Varietal improvement is technically a ten year exercise and yet designs were written in 3 year terms or less. For CIAP, two project extensions have ensured the time has been sufficient and by the end of Phase III 24 varieties had been released. For the Vietnam-IRRI Project AusAID's contribution was more in the training of plant breeders. The varietal improvement results are just as impressive as CIAP but how much can be attributed to the training while other donors provided technical assistance and the government of Vietnam provided funding, could not be determined.

In Laos the LUADP promoted the development of tree crops to stabilise the upland farming systems. AusAID funding for technical assistance terminated before the research and extension services had developed a capacity to continue to support the activity. The evaluation concluded that without further technical assistance and training the activity is not sustainable. As a comparison, it was noted that similar activities being supported by Swedish aid in other provinces have been given an 8 year funding commitment.

The Lesson. There are certain procedures in agricultural development which necessitate a long term commitment to achieve the objective. The breeding of new varieties, the development of tree crops, the participatory approaches of extension are all long term exercises. If AusAID is willing to start the process it must either commit for the full term or ensure its inputs can be sustained to see the term completed. Funding training activities will allow AusAID to contribute the development of skills without long term commitment. However it will be difficult for AusAID to measure the impacts these skills have on development. This was the case in Vietnam where AusAID funded the training of scientists who have gone on to make significant contributions to development funded by UNDP, India and others. Australia's contribution has gone largely unnoticed. If AusAID wants recognition for the Australian funding it will need to advertise its contribution more publicly.

ANNEXES

Annex A

Water Users Group

Water User Groups (WUGs) are considered part of the official apparatus at community level and, conventionally, men are viewed as the household's decision-makers in the public realm. Membership of Water User Groups is based on one representative from each household with irrigable land. The member is understood as the household head who is usually male. However, women do stand in for absent husbands at Water User Group meetings. Widows as household heads usually attend meetings. A number of women represented their husbands who were unable to attend a meeting held between the evaluation team and a Water User Association.

The GOL has prepared guidelines (MAF 1997) which clearly sets out the rights and obligations of the members of a WUG. The Evaluation Team held discussions with WUGs in Nam Pang and Nam Mone irrigation schemes and were impressed with the organizational structure, the level of agreement between members and their ability to collect funds for on-going maintenance.

Discussions revealed that all farmers in the irrigation areas were members of a WUG. A single WUG represented a sub area within the irrigation system. For Nam Pang there were seven WUGs and for Nam Mone six WUGs. The WUGs in each irrigation system formed a single Water User Association (WUA) representing the interests of all farmers in the irrigation area. The Association had a President and a Steering Committee. The Associations met about once per month and levied their members Kip2 500 to K3 000 per year for the salary of the gate keepers and for maintenance costs of the irrigation system.

The farmers interviewed were confident that the WUGs were able to manage and maintain the irrigation systems themselves and would only need external technical assistance and finance in the event of a major disaster such as the collapse of a weir.

The WUGs were responsible for allocation of water in the dry season when only about 50% of the area can be irrigated.

To ensure equity with all members, those in the bottom half of the irrigation area, where water does not reach in the dry season, are given 2 rai (0.32 ha) of land in the irrigated area where they can grow cash crops.

Annex B

Women's Weaving Group – Ban Vang Heua

Weaving is an important activity for many women in the project area. They weave in the cool area under the house where they can mind small children and can easily take care of other domestic responsibilities. This activity also offers an opportunity for neighbours to meet, an important element in the development of women's neighbourhood support networks.

Before the project commenced, women in Ban Vang Heua wove cloth. However, this cloth was mainly for their own use. They usually had very simple designs and the weaving equipment in the village was limited.

With the aid of the project, women formed a group. The number of weavers in the group is currently 50 and they are formed in sub-groups of 10. More than one woman from a household, for example a mother and her daughters, can be a member of a group.

The project provided training in new techniques and a small amount of money to buy training materials and a number of fumes to add to the equipment already available in the village. The leader of the group, who originated from an area in the north known for its weaving, investigated a number of markets including the large market in the capital, Vientiane, to identify the patterns which were most sought after. She brought back examples of a range of more complex and marketable designs than those currently used and these were copied by the women.

There was insufficient weaving equipment available for the group's growing membership and needs. In order to purchase additional equipment the project brought the Agricultural Promotion Bank representatives to talk to the women about taking a loan. After discussion and assessment of risks the bank loaned the group members money. However, the women's husbands, as the heads of households, signed the contracts. These loans have been repaid.

In addition to credit availability, the marketing of the cloth has been an important aspect of the success of this group. As noted above the leader directed production to designs which were in demand in the market. She also operated as a trader, collecting the women's cloths and selling them in Vientiane and regional markets. In addition, she purchased cloth from another group of 30 women in Nam Mone village. Her entrepreneurial skills, which have been allowed to flourish under the project, have contributed significantly to the group's success.

Annex C

Intellectual Property

The owner of the intellectual property (IP) associated with processes or product, entitles the owner to the exclusive right to exploit that product or process commercially. This is generally done through a royalty system.

The situations where IP may be obtained in plant improvement include

- Plant Breeders Rights (PBR)
- Patents on genes or tools for biotechnology

PBR can be obtained on new varieties of crop plants providing that they are distinctive, uniform and stable and have not been grown commercially for a prescribed period. PBR is available in countries that are signatories to the international convention on plant breeders rights called UPOV. UPOV signatories include most of the developed world.

The revenue from PBR is seen as a mechanism whereby a breeding program can become self funding and can provide a revenue stream to companies holding IP on processes or products that the breeder wishes to use to develop a new variety.

The implications for developing countries are

- They are not signatories to UPOV, do not have complementary legislation and farmers are not in a financial position to pay the royalty
- If varieties that are developed by breeding programs in developed countries and are grown in countries that are UPOV signatories, other agencies may acquire the PBR on the varieties and seek to obtain royalties. This has already happened on a variety of aromatic rice.
- Lack of a royalty system precludes the generation of revenue to pay for the use of novel genes etc that have been developed in the private sector
- None of the breeding agencies in the countries visited during the Cluster Review were aware of, or concerned by, the implication of PBR for their countries

Patents

The relevance to plant breeding of patents concerns the exclusive rights to biotechnological processes and gene constructs that can be introduced into crop species to confer, for example, resistance to insect pests. Much of the technology has been developed, or is owned by, private companies such as Monsanto, Novartes, Dupont and Agrevo.

The implication for developing countries is that without a revenue stream, these companies will probably not make the technology available. This may be a considerable disadvantage as transformation offers genetic solution to many recalcitrant problems in developed and developing countries.

The issues for AusAID are

- AusAID should be aware of the implications of Plant Breeders Rights when developing projects that have a breeding component. This may include seeking PBR in developed countries where the varietal products of the AusAID supported program may be grown
- AusAID should be aware that many biotechnological techniques and procedures are patented. Use of this in a breeding program may
    - Infringe patents and result in legal action
    - Require payment for their use
- Innovations resulting from AusAID projects are potentially protectable through PBR or patents and may generate a revenue stream that can defray project costs
- Most patents cost more to obtain than they attract through commercial exploitation
- There appears to be a danger that much of the gene technology will be owned by multinationals and will only be available at a considerable price
- The lack of patent protection legislation or the lack of enforcement of such legislation has not, in the past, allowed unfettered exploitation by developing countries as occurred with CDs and software in China.

Annex D

Terms of Reference: GROWING RICE AND PROTECTING FORESTS: An Evaluation of Three Food Production Projects in S.E. Asia

1.0 BACKGROUND:

In response to the 1994 environment audit of AusAID's programs, AusAID decided that cluster evaluations of environment-related projects should occur every two years followed by an environment systems audit every third year. The first evaluation, conducted in 1997, was of a cluster of energy related projects. This evaluation will examine a cluster of projects related to food production. The evaluation will examine the environmental impacts of the projects as well as particular issues such as food security and the role of women in food production.

Activities which directly address food production may have important environmental impacts. Increased food production has the potential to pollute water supplies through the use of inorganic fertilisers. Increased irrigation may contribute to increased salinity, damage to soil structure, and depletion of ground water Increased food production may also result in destruction of natural forest and expansion into marginal lands and use of inappropriate land forms.

Food production activities are also of current interest because of the WTO outcomes which include undertakings to support LIFDCs through food security assistance and the Minister for Foreign Affairs and Trade's wish to see more food security related activities implemented by AusAID in South Asia. In the countries where the projects to be evaluated are located, women have traditionally been closely associated with food production. Sustainability of agriculture projects will, to a significant extent, depend upon commitment by women to the activities generated by the projects.

The cluster of projects which are the subject of this environment evaluation were designed to improve the food security of the beneficiaries. All projects relate to the use of land for the production of food and food production techniques. The effectiveness of projects in Cambodia, Laos, Bangladesh and Vietnam will be evaluated. The projects are:

Cambodia & Vietnam IRRI Project:

Laos: Upland Agriculture Project (co-financed with World Bank)

Bangladesh: Wheat Improvement Project (funded through CIMMYT)

2.0 OBJECTIVES:

The objectives of the evaluation will be:

firstly,

- to assess the effectiveness of the projects in meeting their stated objectives;
- to assess, relative to the environmental impacts predicted in the designs, the actual environmental impacts of the projects;
- to assess the broad environmental, socio-economic and institutional impacts of the projects, with emphasis on land and water management and off-site impacts;
- to assess whether the implementation of the projects was consistent with the environmental and gender equity guidelines in effect at the time the projects were designed and implemented;

and, in addition:

- to assess whether the outputs of the projects have been, and will continue to be, sustained and will continue to contribute to food security for their immediate beneficiaries; and
- to assess the cost-effectiveness of the projects; and
- to identify key lessons learned from the implementation of the projects particularly with regard to environmental impacts, and make recommendations for future projects.

3.0 METHOD

The evaluation team will be briefed in Canberra and research the backgrounds of the projects through all available documents. The team will have 20 working days in which to do this prior to commencing fieldwork. During this time, the team will also agree a schedule of visits for forwarding to posts. The team will also agree a set of questionnaires designed to elicit relevant information on each project during fieldwork. The team will then travel to Vietnam, Laos, Cambodia and Bangladesh to conduct fieldwork for a period of 25 working days (including weekends). A draft report will be completed prior to return to Australia. The final report will be completed within 5 working days of receipt in writing of AusAID comments.

4.0 SCOPE

In Australia, the Team will:

a) Attend a briefing by AusAID's Advisory Group for this evaluation on the objectives and scope of the evaluation;

b) Survey all documents relating to the projects being evaluated including environment and gender policy documents, project design documents, project implementation documents, project review reports and project completion reports;

c) From the documents, and from interviews with the Managing Agents if necessary, assess whether the projects:

- were successful in meeting their objectives;
- were designed and implemented in accordance with the AusAID environmental guidelines extant at the time and in accordance with recommendations arising from environmental audits of AusAID projects completed before or during the projects;
- were cost effective;
- took account of AusAID's policy on gender equity, specifically by activities to support the role of women in agriculture, during implementation;
- increased the food security of immediate beneficiaries in the terms of:
    - ≈ ensuring that the plant breeding strategies employed should lead to maximum and sustainable yields; and
    - ≈ ensuring that the administrative arrangements under the project allowed for adequate data to be collected from research and extension activities to facilitate preparation of future, sustainable research and extension strategies, as well as ensuring that all research facilities needing the data have had access to the data
- where appropriate, addressed issues of land tenure by people working the land for food production; and
- ensured the transfer of skills and knowledge in agriculture theories and techniques appropriate to the needs of beneficiaries and the environment.

d) Prepare questionnaires for use during fieldwork. The questionnaires are to be designed to ensure that the findings by the Team are verified by respondents;

e) Prepare a draft fieldwork program for transmission to posts.

During fieldwork, the Team will

f) Test the assumptions developed during the literature survey in Australia;

g) Apply the questionnaires developed in Australia to ensure confirmation of findings;

h) Ensure that findings to be included in the report are quantified where possible and that all opinions and views of respondents described in the report are sourced to either the individual or his/her status or office;

i) At each stage of the mission, prepare an Aide Memoire on the Team's findings about the projects specific to that country and clear the Aide Memoire with the AusAID post and relevant recipient government authority;

j) Prepare a draft report prior to departure for Australia.

On return to Australia:

k) Debrief the Advisory Group established by AusAID for this evaluation; and

l) Finalise the report within 5 working days of receipt in writing of AusAID's comments on the draft.

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Growing Rice and Protecting Forests

Australia provides significant support through its aid program to extending the benefits of new rice technology to poorer farmers throughout Indochina.

This evaluation study looks at three AusAID projects in Cambodia, Vietnam and Laos that focus on rice production but which also place a strong emphasis on strengthening the capabilities of national agricultural research institutions. While these initiatives are critical to enhancing the quality of life of poor farmers through better food security, they can also have a detrimental effect on the environment.

Overall, the projects were found to have a minimal effect on local eco-systems. They were assessed as sustainable and effective in improving food security and increasing the incomes of farming families.