Pest Management Framework (PMF)
Mekong Delta Water Management for Rural Development Project

THE SOCIALIST REPUBLIC OF VIET NAM
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

Mekong Delta Water Management for Rural Development Project
(MDWM-RDP)

Pest Management Framework
(PMF)
Preface

This document is called the Pest Management Framework (PMF) for the Mekong Delta Water Management for Rural Development Project (the Project). It was developed as a standalone document as required by the World Bank policy (OP 4.09) and is considered as part of the Environment and Social Management Framework (ESMF). The PMF will be applied to all the subprojects involving irrigation and flood control activities of the Component 2 of the Project. The main objective of this document is to stipulate the framework for the Integrated Pest Management (IPM) program to be prepared and implemented for each subproject under Component 2 as a part of the subproject specific Environmental Management Plan (EMP).

The Central Project Management Unit (CPMU) to be established in Can Tho by MARD will be responsible for overall implementation of the Project. Regarding the IPM Program, responsibilities would be delegated to the Provincial Project Management Unit (PPMU) established at the Department of Agriculture and Rural Development (DARD) and PMU10 who are responsible for implementation of the irrigation infrastructure subprojects as follows:

CPMU: Facilitate and carry out quality control of the preparation of the IPM Programs for each subproject, and monitor the implementation of such programs at the provincial level;

PMU 10 and PPMU: Prepare and implement the IPM Program. The Plant Protection Division (PPD) of the Provincial Department of Agriculture and Rural Development (DARD) and the Regional Plant Protection Department in Ho Chi Minh City would provide technical assistance during preparation and implementation at the IPM Program.
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### Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BVN</td>
<td>Bac Vam Nao</td>
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<tr>
<td>CIPM</td>
<td>Community IPM</td>
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<td>CPMU</td>
<td>Central Project Management Unit</td>
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<td>CPO</td>
<td>Central Project Office of MARD</td>
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<td>DARD</td>
<td>Department of Agriculture and Rural Development</td>
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<td>DNR</td>
<td>Dong Nang Ren</td>
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<td>EMP</td>
<td>Environment Management Plan</td>
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<td>ESMF</td>
<td>Environment and Social Management Framework</td>
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<td>ETL</td>
<td>Economic Threshold Level</td>
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<td>FFS</td>
<td>Farmer Field School</td>
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<td>FPTR</td>
<td>Farmer Participatory Training and Research</td>
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<td>GOV</td>
<td>Government of Vietnam</td>
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<td>IPM</td>
<td>Integrated Pest Management</td>
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<td>MARD</td>
<td>Ministry of Agriculture and Rural Development</td>
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<td>OP</td>
<td>Operation Policy of World Bank</td>
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<tr>
<td>OMXN</td>
<td>O Mon Xa No</td>
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<td>PMF</td>
<td>Pest Management Framework</td>
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<tr>
<td>PMU10</td>
<td>Project Management Unit Number 10 in Can Tho (of MARD)</td>
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<td>PPD</td>
<td>Plant Protection Department of MARD</td>
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<td>PPPD</td>
<td>Provincial Plant Protection Division of DARD</td>
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<td>PPMU</td>
<td>Provincial Project Management Unit</td>
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<tr>
<td>RPPD</td>
<td>Plant Protection Department, Branch Office in Ho Chi Minh City</td>
</tr>
<tr>
<td>TOT</td>
<td>Train-the-Trainer</td>
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<td>WB</td>
<td>World Bank</td>
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Executive Summary

The Pest Management Framework (PMF) is developed to provide guidance for the preparation of an Integrated Pest Management (IPM) program which is considered as a means to mitigate potential negative impacts of the Project due to an increasing use of pesticides, fertilizer, and agro-chemicals in the subproject areas. The IPM Program would be developed for each subproject as a part of the subproject’s Environmental Management Plan (EMP).

Review of experience from the previous IPM training and studies and discussion with local agencies and specialists suggested that while the IPM concept is well accepted at the policy and management at all levels, but its effective implementation remain a challenge due to complexity with pest problems; large number of farmers in which many of them are poor and uneducated; marketing pressure of chemicals and pesticides suppliers; and limited government budget, technical, and management capacity. Key lessons learnt from the previous efforts included (more details in Section 3.4):

- Financial support to the farmer organizations has to be long enough to ensure self-sustaining of this mechanism and technical inputs/training must be periodically provided to update technology and knowledge so farmers could adjust their practices to local change;
- Relationships between poor farmers and creditors and/or chemical suppliers must be addressed and monitoring capacity of local agencies to implement the regulations must be strengthened; and
- Health aspects on poor farmers and local consumers should be seriously addressed.

In this context, the following activities have been identified as priority for the Project support:

- **First** is to strengthen farmer’s capacity through the present farmer organization network so that they could adopt good practices as well as could develop and/or adjust knowledge and technology according to their farming situations.
- **Second** is to focus on development of non-chemical options through close cooperation between local institutes and farmers.
- **Third** is to strengthen regulatory, monitoring, and other complimentary measures that could address the issues related to health aspect and control of toxic chemicals, including training of suppliers and traders.
- **Fourth** is to providing special assistance to poor farmers and vulnerable groups.

To translate these principles into actions under any specific IPM programs, the PMF has established specific target, tasks, and implementation arrangement for preparing IPM program as follows:
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- The target of the IPM program: 50% reduction of pesticides and 10% reduction of fertilizers compared to the baseline data starting in 2011 with the 5 first cycle subprojects;

- Key tasks include:
  - Task 0: Undertaking an assessment and setting up a baseline.
  - Task 1: Farmer adoption of good IPM practices and safe use of pesticides;
  - Task 2: Adoption of non-chemical uses and farmers outreach
  - Task 3: Special assistance to poor farmer and vulnerable groups
  - Task 4: Strengthen regulatory measures.

- Implementation arrangement: 4 steps
  - Step 1: Set up baseline and farmer registration
  - Step 2: Setup program target and detailed work plan
  - Step 3: Implementation and annual evaluation
  - Step 4: Impacts evaluation

In order to assist in preparing and implementing the IPM Programs, the project has allocated US$3.0 million to support the following: (a) recruitment of national technical experts to develop an IPM Program for each subproject, (b) engagement of technical experts and purchase of demonstration material/equipment to assist farmers within the subproject areas, the PPD, and the PPMU in implementing the IPM Program; and (c) financing the program. The cost for the monitoring the implementation of the IPM Programs have been appropriated under the overall monitoring on the safeguard implementation, which would be carried out by the CPMU.

While majority of the IPM Program would be targeted at the agriculture area, the IMP Program would also address the potential negative environmental impacts of the aquaculture farms. Majority of the aquaculture farms are of small scale and are run by families, and currently detailed information on the current practices are not available. In parallel to the implementation of the subproject specific IMP Program, a study would be carried out to: (a) develop an inventory on the shrimp farms in the project provinces and develop some typologies (area, ownership, target species), (b) review the current practices on the aquaculture farms and the use of the chemicals depends on the typologies, (c) identify the critical environmental issues (e.g. water quality, sediment) and develop a monitoring plan, and (d) explore good practices appropriate for local conditions that could be used as a basis for the possible up-scaling.
Section I Introduction

1. The Project and potential impacts. The Government of Vietnam (GOV) will be implementing the Mekong Delta Water Management for Rural Development Project (the Project) during 2011-2016 with financing support from the World Bank (WB or the Bank). The development objective of the Project is to protect and enhance the utilization of water resources in the Mekong Delta region in order to sustain gains in agricultural productivity, raise living standards, and contribute to climate change adaptation. The Project will be implemented in three subproject cycles and the Project areas will cover 6 provinces of Soc Trang, Bac Lieu, Ca Mau, Hau Giang, An Giang, Kien Giang provinces and one municipality of Can Tho. (see Annex 1 for Project description and locations of the Project areas). Implementation of Component 2 subprojects will enable farmers to access to more reliable agricultural water. Increasing agriculture productions may imply increase the use of fertilizer and pesticides and therefore measures must be undertaken to mitigate the potential impacts on the health of farmers as well as on local environment and agriculture products.

2. Scope and application. The WB’s safeguard policy on pesticide (OP4.09) adopts the following approach\(^1\) for the application of an Integrated Pest Management (IPM): “an IPM refers to a mix of farmer-driven, ecologically based pest control practices that seek to reduce reliance on synthetic chemical pesticides and it involves (a) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (b) relying, to the extent possible, on non-chemical measures to keep pest populations low; and (c) selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment. The PMF for this Project has been prepared in line with this definition and it will be applied to all the subprojects involving irrigation and flood control. The PMF has been designed to minimize potential adverse impacts on human health and the environment focusing on promotion of safe use of agrochemicals, exploring options for non-chemical uses, and sustainability of good practices.

3. Baseline and target. Given that a number of research activities on pest management, IPM practices, and farmer’s behaviors were carried out in the Mekong Delta during the past 10 years and the presence of Government policy to promote rice production by reduce the use of seed, water, fertilizer, and pesticides (under the slogan “Three Reduction, Three Gains”), it is anticipated that about 50% of pesticide and 10% of fertilizer uses in the Project areas could be reduced through a combination of effective campaign, strengthening farmer organizations, and regulatory actions. Given that pest problems vary significantly with type of agriculture production, locations, seasonal and local environment as well as knowledge and practices of farmers and local officials, it is important that the IPM program should be designed to forge effective cooperation among key agencies, farmers, and local researchers to address the pest management issues together and final program should be finalized and accepted by them to ensure ownership and commitment. The PMF therefore adopts this target and approach and

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\(^1\) Definition: An IPM refers to a mix of farmer-driven, ecologically based pest control practices that seek to reduce reliance on synthetic chemical pesticides. It involves (a) managing pests (keeping them below economically damaging levels) rather than seeking to eradicate them; (b) relying, to the extent possible, on non-chemical measures to keep pest populations low; and (c) selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment.
identifies four steps to be implemented during the project implementation: (1) establishment of baseline data and registration of farmers; (2) finalization of IPM program; (3) implementation of activities; and (4) impact assessment. Details are provided in Section IV.

4. **Implementation arrangement and responsibility.** The Central Project Management Unit (CPMU) to be established in Can Tho by MARD will be responsible for facilitating and quality checking provincial-level IPM Program as a part of the subproject EMP. The Provincial Project Management Unit (PPMU) established at the Department of Agriculture and Rural Development (DARD) and PMU10 who are responsible for implementation of the subprojects related to irrigation/flood control investment will prepare an IPM Program for the subproject. The PPMU will seek technical advices and cooperation from the Regional Plant Protection Department (RPPD) at Ho Chi Minh City of the Ministry of Agriculture and Rural Development (MARD) and the Provincial Plant Protection Division (PPPD) at the provincial level. The EMPs will be subject to the Bank’s prior review and approval once quality check has been done by CPMU. Upon Bank’s approval, the implementation of the IPM Program would be carried out by PPMU/PMU10. In implementation, the PPPD of the DARD in the respective province would be responsible for implementation of the regulatory strengthening aspect under technical guidance of RPPD. The CPMU and RPPD of the MARD will be overseeing and monitoring the implementation of the subproject IPM Program.

5. Section II below summarizes the Government policy and regulations related to pesticides and IPM practices while Section III provides background on pest management and IPM experience in the Mekong Delta and the Project area. Section IV outlines the approach and process to be used in formulating and implementing the subproject IPM Program. Additional technical guidelines are provided in Section V.

**Section II Government Policy, Regulations, and Institution**

**2.1 Policy and Regulations related to Pesticides and IPM**

6. **Pesticides control:** In 1990, Vietnam officially approved and adopted the *International Code of Conduct on the Distribution and Use of Pesticides* of the Food and Agriculture Organization of the UN (FAO) and the regulatory system was developed in line with FAO guidelines in mid 1990's. The Ordinance on Plant Protection and Quarantine was enacted in February 1993, followed in November by Decree 92/CP with regulations on pesticides management. These regulations are updated periodically and are being applied by the agencies. During 1995-97, a total of 45 pesticides were banned for use in Vietnam and 30 have been restricted (amount cannot exceed 10% of total pesticides sold in Vietnam). These include the highly toxic pesticides such as carbofuran, endosulfan, methamidophos, monocrotophos, methyl parathion, and phosphamidon. In 1998, Vietnam stopped the registration of new insecticides for leaf-folders into the country since IPM activities had shown that insecticides use against leaf-folders is unnecessary.
Below lists key regulations related to pesticides control in Vietnam:

- Decision 193/1998/QD BNN-BVTV dated December 2nd, 1999 by MARD promulgating the regulations on quality control, pesticide surplus and new pesticide testing in order to registration in Vietnam.
- Decision 145/2002/QD/BNN-BVTV dated December 18th, 2002 by MARD promulgating the regulations on procedures for screening production, processing, registration, export and import, trading, storage and disposal, label, packaging, seminars, advertising and use of plant protection pesticides; This is the basis for GOV monitoring the use and storage of pesticides.

National Policy on IPM: Application of the IPM concept in Vietnam has been introduced in early 1990's. A national IPM program was prepared and implemented (see Section III) and a Steering Committee on IPM, chaired by a vice-Minister of MARD, was established and responsible for supervision of the program. During the period, a number of policy and regulations supporting the IMP was developed including bans and restrictions of toxic pesticides and operations of an inspection system. Additional measures to reduce the risks due to pesticide uses have also been carried out through a number of research activities and those related to the Mekong Delta are highlighted in Section III.

"Three Reductions, Three Gains" ("3R3G"): This policy has been adopted nationwide. MARD established a national committee to develop plans for implementation of this policy in 2005 and allocated about $230,000 to 64 provinces in 2006. This policy was developed based on the concept of a crop management technology designed by the International Rice Research Institute (IRRI) to reduce production costs, improve farmers' health, and protect the environment in irrigated rice production in Mekong Delta through the reduction on use of seeds, nitrogen fertilizer, and pesticides. This concept was based on the research findings showing that early spraying was unnecessary as any damage from leaf-feeding insects (the prime cause of early spraying) did not affect yield. A campaign called "No Early Spraying" (NES) through various media was conducted with an aim to reach about 92% of the 2.3 million farmer households in the Mekong Delta and the result suggested that the number of insecticide sprays per season dropped by 70% (from 3.4 to 1.0 time/crop). The research also suggested that in Mekong Delta farmers tended to apply high seeding rates -about 200–300 kilogram per hectare (kg per ha) and nitrogen applications of around 150–300 kg per ha. PPD with assistance from Danida conducted a study, involving 951 farmers, showed that seeds, fertilizers, and insecticides can be reduced by 40 percent, 13 percent, and 50 percent, respectively. The NES practice was then packaged with lower seed rates and lower nitrogen use and became known locally as Ba Giâm, Ba Tàng ("3R3G").

"One Must Do, Five Reductions": Built on the success on "3R3G" campaign, additional researches were carried out to demonstrate that appropriate reduction of production inputs (water, energy, seed, fertilizer, and pesticides) and post harvest-loss without reducing yield could be made and the three reductions should be extended to cover five reductions. This approach
promotes the use of certified seed (this is considered as “one must do”) and the application of modern technology to promote efficiency in water and energy uses and reduction of post-harvest loss. The five reductions therefore cover water, energy, post-harvest loss, fertilizers, and pesticides. Implementation of this campaign however will be more complex and require additional investment and technical assistance as well as effective cooperation among MARD agencies involving in irrigation and production managements. Following a successful demonstration in An Giang province, MARD is moving towards modernization and development of best practices for scaling up this approach in the entire Mekong Delta region including the project command areas.

2.2 Institutions and Capacity

11. The Plant Protection Department (PPD) of the Ministry of Agriculture and Rural Development (MARD) is responsible for pesticide management at national scale and has been taking the lead in promoting IPM program, including the implementation of the national IPM program in the past. In the Mekong delta, the PPD branch office (referred to as the regional PPD) in Ho Chi Minh City is responsible for managing fertilizer and pesticide uses and undertaking measures to reduce the risks to public health. During the past ten years they have actively participated in many research activities related to pest management in the Mekong Delta and have extensive experience in the planning and undertaking educational and awareness raising for farmers (through the farmer club), including production of training and awareness raising materials. The PPD branch office in Ho Chi Minh City has a small laboratory that could be used to analyze pesticides in agriculture products. However, limited GOV budget is a constraint for moving proactively in ensuring effective management of pesticides in the Mekong Delta. Some of the key issues are discussed in Section III.

12. At provincial level, the Plant Protection Division (PPPD) is responsible for forging effective management of agro-chemicals and pesticides uses in coordination with PPD at regional and/or national level and the extension services of the Department of Agriculture of MARD -DARD. The PPPD in the Project provinces are quite familiar with the IPM and participated in the previous research and training, however, their technical and management capacity regarding regulatory monitoring and laboratory analysis appears inadequate. This issue is discussed in more details in Section III. Under DARD, the extension services division/staff will also be responsible for providing technical assistance in the area of aquaculture development. There is one extension center in every province, one extension group in every district, and one extension officer at each commune and village.
Section III Pest Management Practices

3.1 Pest Management in Mekong Delta and Project Areas

(a) Pest Problems

13. Pest problems vary with seasons, locations, and types of crops. For rice production, most common pest problems are leaf-feeding insects and followed by stem borers (brown plant hopper and plant hopper of all types, worms (trunk eating worm, leaf-fold worm, stingy worm (sâu keo)), bugs (black stink bug, etc), etc. Major diseases include: Sheath blight disease, rice blast, brown spot, stem rot, irregular stem rot, and empty paddy grain. Other epidemics include yellow snail, rat, etc. For fruit trees and food crops, pest problems are more diverse including leaf-fold worm, Rice blast, brown plant hopper, three leafs worm, fruit eating works, grey works, maize eating worms, bugs and sheath blight, mildew, etc. Review of previous research and background data provided by the province during the Project preparation suggested that in the Project areas, the following problems were observed:

- In BVN and OMXN, problems include brown plant hoppers, small rice leaf folder, rice yellow stunt disease, rice ragged stunt virus diseases, rice blast disease, rats, Oligonyx Oryzae, sheath blight, flat seeds, rice case bearer, Pyralidae sp., rice thrips.
- In Bac Lieu province, including Dong Nang Ren: Brown rice backed hoppers, rice leaf folder, Rice thrips, Rice leaf blast disease, OPV disease, etc. See sample data in Annex 2.

(b) Use of pesticides

14. Pesticides were extensively used without any control in Vietnam during 1950’s to 1998 when agricultural production was limited to cooperatives, collective farms, and state farm enterprises. Applications increased from 20,000 tons/year in 1991 to over 40,000 tons per year in 1998 and begin to reduce in 1999. A nation-wide survey conducted by the PPD in 2000 found 2,500 kg of banned pesticides in use (methamidophos, DDT and other chemicals), along with 4,753 liters and 5,645 kg of illegally imported or counterfeit pesticides (PPD, 2000). Another survey was conducted in August 2000 and it was found that of 480 farmers in four provinces in the South, about 97% used pesticides more intensively than product labels recommended, and nearly 95% of farmers disposed of any remaining pesticide by pouring it into canals or ditches, reapplying it to the same crops, or spraying crops that were not identified for initial use.

14. Amount of pesticides, fertilizers, and agro-chemicals used vary greatly depending on type of crops and practice of farmers. Some data suggested that about 100-200 kilogram per ha per year (kg/ha/yr) of urea, 200 kg/ha/yr of phosphate, 100 kg/ha/yr of potassium (KCl), 0.53 kg/ha/yr of herbicides, 1.5 kg/ha/yr of pesticides, and 1 kg/ha/yr of other chemicals were used.
In Mekong Delta, an average fertilizer and pesticides uses and the guidelines provided to farmers in promoting the “Three Reductions, Three Gains” campaign were listed below.

<table>
<thead>
<tr>
<th>Average Inputs</th>
<th>Seasons</th>
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<tbody>
<tr>
<td></td>
<td>Winter-Spring (2001-2002)</td>
</tr>
<tr>
<td></td>
<td>Summer-Autumn (2002)</td>
</tr>
<tr>
<td>Nitrogen (kg/ha)</td>
<td>83.4-95.4</td>
</tr>
<tr>
<td>Phosphorus (kg/ha)</td>
<td>46.2-55.2</td>
</tr>
<tr>
<td>Potassium (kg/ha)</td>
<td>36-40</td>
</tr>
<tr>
<td>Insecticides (kg/ha)</td>
<td>0.36-1.65</td>
</tr>
<tr>
<td>Fungicides (kg/ha)</td>
<td>0.30-1.31</td>
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<tr>
<td>Mean rice yields (kg/ha)</td>
<td>6.30-6.46</td>
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Guideline for inputs

<table>
<thead>
<tr>
<th>Seed rates (kg/ha)</th>
<th>Winter-Spring</th>
<th>Summer-Autumn</th>
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<tr>
<td>70-100</td>
<td>100-120</td>
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</table>

Fertilizer rate (for alluvium soil)*

| Nitrogen                         | 120           |
| Potassium                        | 30            |
| Phosphorus                       | 30            |

*Notes: Farmers are provided a leaf color chart to determine if N is needed (depend on the green color of the leave); Use of insecticide is not recommended during the first 40 days for leave feeding insects, for others insecticides can be used as needed; Use of disease control—when blast symptoms and sheath blight are visible during the booting stage, fungicides might be used as needed.

15. The social survey carried out in the Project areas in December 2010 suggested that of 2,000 households surveyed about 1,204 households use fertilizers during the past two years, of which there are only 16 households do not use pesticides. The average volume of fertilizers used by these farmers per crop is 53.3 kilogram (kg) per 0.1 hectare (ha) or 1,000 square meters (m²) (equivalent to 533 kg/ha) while an average volume of pesticides uses is about 160 milliliters (ml) per 0.1 ha (equivalent to 1.6 liter/ha).

3.2 IPM Practices in Mekong Delta

(a) The National IPM Program

16. Recognizing the adverse impacts of pesticides on local environment and farmers, the Government through the leadership of PPD and with funding support from various donors (FAO, Norway, Denmark, Switzerland, etc.), implemented a national IPM program in 1995-2004. The program was designed based on the four IPM principles: grow a healthy crop, conserve natural enemies in the field, observe the field regularly, and farmers become experts and the activities focused on empowerment of small-scale farmers to become skillful and better informed in managing the rice production system through training activities. A comprehensive training program, namely the Training-of-Trainers (TOT) and Farmer Field School (FFS), was developed and implemented and key beneficiaries were government officials at central and local level and selected farmers. The FFS focus on training of 25-30 farmers in a village using a farmer-centered participatory and non-formal education process. Limited training was also provided for other crops such as soybeans, peanuts, vegetables, citrus, maize, sweet potato, tea, and cotton. Due consideration was also given to promote women participation in the program. In 1998, the national IPM program facilitated the development of local IPM groups namely the Community IPM (or CIPM) network. The CIPM concept had been expanded to 19 provinces (121 villages in 29 districts) at the end of 2000. CIPM covers a broad range of activities including training, research, and communication forum and the farmers are responsible for making their own plan and implement the activities. Attention was also given to promote active participation of women as well as on health and environment aspects however limited budget prevented any expansion of the activities.

(b) IPM Practices in the Mekong Delta

17. Rice production is the major land use in the Mekong Delta and the Project areas while land use for other high-valued crops such as fruit trees, vegetable, and aquaculture are increasing. The Mekong Delta covers an area of about 2 million ha of rice filed and involves about 2.3 million farmers while rice production was about 17 million tons per year (51 percent of Vietnam’s annual production). Rice production in Vietnam increased from 10.3 million tons in 1975 to 32.5 million tons in 2000 and is now a net exporter. Farm sizes are generally less than 1 ha and the average income is less than $US 23 per person per month. Given that the Mekong Delta is the major “rice bowl” for the country, the area has been the target for a number of studies and surveys related to pesticide application as well as several research and development. Between 1992 and 1997, two insecticide reduction interventions were introduced to farmers in the Mekong Delta as part of the national IPM i.e. a media campaign to motivate farmers to experiment whether early season spraying for leaf folders was necessary and FFS training. It was reported\(^3\) that the media campaign reached about 92 percent of the 2.3 million farmer households in the Mekong while the FFS trained about 108,000 farmers or 4.3 percent. Farmers' insecticide use, early season sprayings and pest management beliefs reduced markedly over the 5-year period. Spray frequencies changed from 3.4 to 1.0 spray per season; less farmers sprayed

\(^3\) Changes in rice farmers' pest management in the Mekong Delta, Vietnam; N.H. Huan, V. Mai, M.M. Escalada, K.L. Heong; Published by Elsevier Science Ltd. All rights reserved. Crop Protection 18 (1999) 557-563.
during seedling, tillering and booting stages; and changes in farmers' beliefs were significant. Spray frequencies of 0.5 were observed from farmers who were reached by media compared to 1.2 by the farmers trained by FFS, and 2.1 by the farmers that were not reached by either intervention.

18. In 1999, a survey\(^4\) was conducted to assess pest management practices among rice farmers and their perception of problems related to pests and pesticides, including the influence from the national IPM program. The study interviewed 120 farmers from three different districts in the Can Tho and Tien Giang provinces during the spring of 1999. The results suggested that about 64 different pesticides were used of which about 50 percent were insecticides, 25 percent were fungicides and 25 percent were herbicides. The main insecticides used were pyrethroids (42 percent) carbamates (23 percent) and cartap (19 percent). Non-IPM farmers used twice as many pesticides as IPM farmers. Their application frequency and the amount of active ingredient used were 2–3 times higher per crop, as compared to IPM farmers. During the last three years IPM farmers estimated that they had decreased the amount of pesticides used by approximately 65 percent, while non-IPM farmers said that they had increased the amount of pesticide used by 40 percent. Also, farmers growing fish in their rice fields used less pesticide than farmers growing only rice, as pesticides adversely affect cultures of fish. Taking a long-term perspective integrated rice–fish farming with IPM practices provides a sustainable alternative to intensive rice mono-cropping, both from an economic as well as an ecological point of view.

19. \textit{The Impact of the IPM Program in the past}\(^5\). A study was conducted using 12 survey data sets conducted in 1992 to 2007. It was concluded that farmers' pest management practices, reflected in the number of insecticide sprays they apply in a season, decreased immediately after interventions, such as the mass media campaign, the radio soap opera, and farmer field school training. However after a few years, their insecticide sprays relapsed as the practices learned were discontinued. Farmers' reliance on pesticides as the main means of pest control had remained relatively unchanged. The phenomena could be attributed to the lack of follow-ups after each of the interventions and the increase in frequency of pesticide advertising. The farmers' average age over the period had also remained unchanged, implying that there had also been a turnover of farmers. In order to make the impacts of the IPM Program, it is important that follow up programs be implemented by the DARD and the PPD of the MARD upon completion of the project, while the project could support the implementation of the IPM Program through campaigns, education, or season-long training programs.

\(c\) Health Implication in the Mekong Delta

\(^{4}\) Pesticide use in rice and rice–fish farms in the Mekong Delta, Vietnam; Hakan Berg, Department for Research Cooperation (SAREC), Swedish International Development Cooperation Agency (Sida), SE-105 25 Stockholm, Sweden, Received 30 June 2000; received in revised form 5 January 2001; accepted 26 February 2001.

20. In 2004, two studies (funded by the Bank)\(^6\) were conducted to explore the consequences of use of pesticides among the poor and its health implications. The study on the use of pesticides (knowledge and behaviors of farmers) using a set of questionnaires and interview with the target groups focusing on awareness of the risks of pesticide use, behavior patterns related to pesticide use, and access to information about risks and protective measures while the study on health effects of pesticides was made using questionnaires as well as medical examination. The study (2004-05) surveyed 603 rice farmers in 10 districts including four in the western part of Mekong delta (Vinh Hau, Binh Hao, Vi Tan, and Thanh Thrang) about their cropping systems, pesticide use and practices, application precautions, risk-averting behavior, and health effects. Households with per capita income below 1.2 VND per year (13 percent of the sample) are defined as poor in the survey sample and compared with other households (defined as non-poor).

21. The health study\(^7\) assessed the actual extent of health problem in the first quarter of 2004. With 482 farmers and both the survey and clinical data were collected. Structured questionnaires were used to collect information on farming systems, pesticide use and practices, applicator precautions, protective measures, and self-reported poisoning symptoms. All participating farmers were examined by the doctors from the Vietnam Association of Occupational Health. The medical survey covered the districts of An Phu and Chau Thanh (An Giang province), Thot Not and Vi Thanh (Can Tho province), Tan Thanh and Thu Thua (Long An province), Cai Lay and Cho Gao (Tien Giang province), and Tra Cu and Tieu Can (Tra Vinh province) in the Mekong Delta. The medical tests suggest that the incidence of poisoning from exposure to organophosphates and carbamates is quite high in Vietnam.

22. Below summarizes some of the key findings from these two studies:

- **Wide spraying practices:** Eighty-six percent of the surveyed households reported spraying pesticides every year; Rice was cropped three times a year; Pesticide doses applied in the rice fields are not the same between seasons; More poor people use pesticides, but amount that they used is less than non-poor; The poor seem to use the most toxic pesticides;

- **Inadequate use of safety equipment.** The poor farmers tended to use masks and other protective measures less often; about 42 percent of the poor did not use a mask (likely to use no protection other than a shirt and trousers) and 36 percent of the nonpoor farmers did not use a mask. Use of gloves and eye glasses appeared lacking.

- **Inadequate access to information:** Both poor and nonpoor have access to information. Public media, pesticide companies, and agricultural extension staff (especially for the poor) appeared to be the sources. About 30 percent of the poor stated that using pesticides has a high risk compared to 21 percent of the nonpoor farmers. Only 1 percent of the poor

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\(^6\) World Bank report: PEN study report, 2010

in the survey had no primary education; more than 45 percent had studied beyond primary school.

- **Limited Access to training:** Less than half of the farmers have access to training on IPM and only 9 percent of the poor and 16 percent of the non-poor farmers stated they used IPM technologies. Majority of the farmers (About 79 percent of the poor farmers—versus 68 percent of the non-poor) stated that they did not use any pest control method other than pesticides. More than 60 percent of farmers in the survey are aware of water pollution from pesticides, and 27 percent stated that wildlife could be affected.

- **Selection of the pesticides by price.** More than half of the poor farmers purchased pesticides on credit and product selection depended on the credit providers. Price of pesticides is the basic criteria for selection of pesticides (not technical effectiveness or safety).

- **Recruitment of the landless for spraying pesticides:** Many of the poor and landless people are not farmers but are employed to spray pesticides and they do not have any choice in selecting the pesticides. The practice of hiring sprayers is common in the Mekong Delta area. Rural poverty is often related to landlessness in the Mekong Delta.

- **Negative impacts on health:** About 60 percent of farmers experienced skin irritations, headaches, dizziness, eye irritations, shortness of breath, and other acute short-term health effects after spraying pesticides. It was believed that these symptoms were related to pesticide use. Blood tests indicated significant exposure to organophosphates or carbamates among 42 percent of the poor versus 32 percent of the nonpoor. Thirty-eight percent of the poor versus 31 percent of the nonpoor reacted positively to patch-skin tests for contact dermatitis, indicating existing exposure to pesticides. In subsequent specific tests of reaction to three commonly used pesticides, only 15 to 25 percent of the farmers tested positive, and there was no clear distinction between poor and nonpoor.

23. Key recommendations and conclusions are that any effort to reduce the use of pesticides should ensure that problems that are specific to the poor are better incorporated into the program. The problems include knowledge on pesticide toxicity, not use of protective equipment, and encouraging the poor to adopt IPM approach and technologies. Capacity-building and agricultural extension service programs need to bring practical solutions to the poor to help them as much as possible. The poor are poor in terms of land, value of house, and access to formal credit. No difference in accessing to basic training on safe handling & spraying pesticide between the poor and non-poor, but in formal training in IPM. The poor are more awareness of risk of exposure to pesticide. Pesticides not legally used in Vietnam are still prevalent.

### 3.3 IPM Practices in Project Areas

24. Most of the provinces responsible for implementation of the subprojects have IPM experience through participation of the research programs mentioned above (Section 3.2).
Experience below suggested that these provinces are ready to move forward the implementation of IPM as part of their routine programs.

- **An Giang province/Bac Vam Nao first cycle subproject**: Agriculture area is about 33,766 ha and most of them are used for rice production and 2-3 crops have been a normal practice. During 2003-2008, An Giang province has demonstrated its commitment to apply the “3R3G” and spent about $1.5 million in production various communication media and provide 1,031 training sessions, 827 demonstration plots, etc. including distribution of about 200,000 leaflets and 12,000 poster were distributed and 31 billboards were erected in rural areas. This effort adopted a participatory planning and review process from the project concept to implementation that could promote quality partnerships, local ownership, mutual trust, and respect as well as an integration of ecological, agricultural, and social benefits incorporating with the application of social marketing techniques, such as branding, framing of messages, and motivating adopters. It was however noted that after the campaign has made progress, follow-up actions would be necessary to sustain the benefits of the campaign and with periodic activities to monitor the progress and track changes in farmers’ inputs, behavior, and attitudes. In 2005, an initiative to promote a non-chemical option focusing on the role of women and the use of rice straw with organic waste to replace fertilizer was carried out in Bac Vam Nao with assistance from AusAid. The activities are on-going and should be reviewed for possible scale up.

- **Can Tho, Hau Giang and Kien Giang provinces/OMXN first cycle subproject**: covers an agriculture area of about 41,000 ha of the three provinces (Can Tho, Hau Giang and Kien Giang). Given the nature of freshwater nature, most of the areas in the east would comprise of 2-3 rice crops, orchards, and fruit trees while those near the west end which experience brackish water grow pineapple and other crops. The farmers also had experience in the implementation of IPM program as part of the previous World Bank project as well as through their participation in various research activities. A brief review of pest management measures in OMXN conducted during the preparation of an EMP for OMXN subproject suggested that the area also experience pest problems and is making an effort to reduce the use of fertilizer and pesticides. A plan has been developed including various IPM options (i.e. development of seasonal calendar, orientation of plantation structure, “3R3G”, etc.); training to farmers on knowledge to address various type and status of pest problems; monitoring of agriculture practices and pest diseases, water quality and weather conditions as well as of heath risk to consumers; and cooperation activities with local institute (Can Tho university and South Plant Protection Center). However, limited GOV budget has delayed the implementation of the overall plan and limited effective application of regulatory measures (can monitor about 42 percent of total agro-chemical suppliers). Recent monitoring suggested that of the 189 suppliers 40 could be classified as violation due to sale of expired pesticides and fertilizers, expired trade certificates, lack of business licenses, wrong storage, etc. Regulations and procedures related to pesticides storage, transportation, and uses have been established (see Annex 3), but there implementation will require effective training,

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8 Pest management plan for OMXN, a paper summarize key findings prepared during the implementation of the project.
monitoring, and enforcement. It is noted that counterfeit pesticides and low quality fertilizers appear to be a major problem and that a quality assurance agency of Hau Giang province is newly established and its technical and management capacity remains lacking.

Bac Lieu province/Dong Nang Ran (DNR) first cycle subproject: About 8,500 ha of agriculture area is used for rice production (2 crops) while other area is used for sugarcane, fish/shrimp farming. Similar to other provinces, Bac Lieu province also had experience in IPM implementation and training. The province is proposing to conduct a pilot program in the area to promote "safe and high quality product" and to provide extensive training to farmers through the farmer organization networks.

3.4 Priority Activities for Project Support

(a) Lessons Learnt

25. Review of experience from IPM training and assessment from previous studies suggested that while the IPM concept is well accepted at the policy and management at all levels, but its effective implementation remain a challenge due to complexity with pest problems; large number of farmers many of them are poor and uneducated; marketing pressure of chemicals and pesticides suppliers, and limited government budget, technical, and management capacity. Previous efforts suggested that:

- With technical training, sharing of knowledge and experience, and appropriate outreach mechanism farmers could be convinced, encouraged, and trained to adopt good practices and farmers organizations could be established. However these efforts must be long and comprehensive enough to facilitate self-sustaining of the farmer organizations and technical inputs/training must be periodically provided to update technology and knowledge. Given that pest populations are normally parts of local ecosystems, effective cooperation between farmers, researchers, and extension services should be designed to facilitate cooperation and partnership among key stakeholders and this will ensure effectiveness and sustain the benefits of the previous IPM efforts. Normal allocation of GOV budget for this objective will be necessary.

- Relationships between poor farmers and creditors and/or chemical suppliers seem to be an important factor affecting farmer’s decisions to select pesticides and chemicals. Most farmers are poor and uneducated so they could be easily influence by other pressures especially when their own organizations are not well established and self-sustaining. Many of poor farmers follow advice from suppliers through personal discussion and/or advertisement.

- Health aspects on poor farmers and local consumers should be seriously addressed. Given the current condition, high concentration of residue pesticides in agriculture products, especially vegetable and food crops could be expected and some analysis of residual pesticides in selective samples had confirmed this assumption. Although this condition occurs in all developing countries, but for the Mekong Delta, it is important to address these issues as soon as possible.
(b) Approach and Priority Activities

26. Discussion with local staff and individual specialists suggested that given the IPM implementation experience and the Government policy to promote “Three Reductions, Three Gains” and/or “One Must Do, Five Reductions” in the Mekong Delta reduction of 50 percent pesticide use and 10 percent fertilizer use is possible in the Project Area. However, the IPM program, agreed targets, division of responsibilities, and implementation schedule must be discussed and finalized through close consultation and agreements among key stakeholders to ensure ownerships and commitment of key agencies and famers. At the end of the program an impact assessment should be carried out to assess effectiveness of the IPM implementation. The issues related to sustainability of training and health aspect can be addressed through capacity building of the IPM farmer organization (club) network that have been established, but additional mechanism should be developed to enhance sustainability and relevancy of these organizations and their responsibility could be extended to address the health aspect issue. To ensure effectiveness and sustainability of these efforts, complementary activities related to regulatory measures and technical development must be carried out to address the issues related to suppliers and development of technology that are appropriate to local conditions.

27. In this context, the following activities have been identified as priority for the Project support:

- **First** is to strengthen farmer’s capacity through the present farmer organization network so that they could adopt good practices as well as could develop and/or adjust knowledge and technology according to their farming situations. The responsibility of the network should also be extended to cover knowledge on health aspect and some limited resources will be made available for providing health service to poor farmers, ethnic minority, and vulnerable population that are involve in the use of pesticides. Close coordination with the irrigation managers, the extension services, local researchers, and public health agencies will be necessary while involvement of women union and local NGOs will be encouraged. Additional mechanism will be developed to ensure sustainability of this network. The IPM program should also be extended to the area where rice farming and aquaculture may create a social conflict (such as Ca Mau and Ninh Than Loi subproject in Bac Lieu province) and the activities should be designed to promote good practices for shrimp/fish farming as well.

- **Second** is to focus on development of non-chemical options through close cooperation between local institutes and farmers. There are a number of on-chemical options in the context of IPM approach. These include Calendar based preventative pesticide applications; Use of insecticides, while insect damage is likely to remain within levels that can be compensated by the plant; Use of herbicides, while weed problems can be economically managed through cultural practices; and Use of fungicides, while fungal diseases can be avoided by better selection of crop varieties and better fertilizer management. There are at least two programs that should be reviewed and promoted with an aim to reduce to reduce the use of pesticides and fertilizer in the subproject areas. First is the project that promoted the role of women and the use of rice straw with
organic waste to replace fertilizer in Bac Vam Nao area in An Giang province which was initiated several years ago with AusAide assistance. Second project is recently (2009-2010) implemented in Cai Lay and Cai be districts of Tien Giang province which promotes the application of biological mechanism as a means to control pest and/or virus. Two demonstration sites (about 30-45 ha), which were seriously affected by Brown Plant Hopper (BPH) and viruses, were selected for growing the nectar rich flowers in the rice field and the results are found to be satisfactory. With appropriate planting time, bright color and suitable smell of flowers, the plants attracted a large number of natural enemies of the BPH. Other approaches could also be considered.

- Third is to strengthen regulatory, monitoring, and other complimentary measures that could address the issues related to health aspect and control of toxic chemicals. Policy, regulations, and institutional framework are well established in the Mekong Delta however technical and management capacity of key agencies to implement the regulations given a number of responsibilities and limited staff and budget. Awareness and knowledge of retailers seems to be an important factor. To ensure sustainability and effectiveness of the IPM program, capacity and performance of the agencies have to be strengthened. Priority investment however should be given to (a) update registration of pesticides suppliers and/or retailers in the provinces and/or Project areas, (b) provide training and education to retailers, agricultural extension workers, and farmers on health aspect, GOV regulations, and the risks of extensive pesticides uses, including information on initial treatments, (c) conduct periodic sampling and testing of residual pesticides and make the results available for public access, including information on pesticides suppliers/importers. Active participation of the chemical suppliers and/or importers and traders could help increasing effectiveness of the GOV effort to control pesticides uses and protection of farmers and public health. A social study to identify relationship between farmers and supplier/retailers could help identifying specific measures to help poor farmers (see below).

- Fourth is to providing special assistance to poor farmers and vulnerable groups. Poor farmers seemed to have equal access to knowledge and information on the danger of pesticides and the concept of IPM however this seems to be inadequate to change their safety practice. It is believed that key barriers for this are the lack of financial capacity to acquire safety equipment and the need to reduce the production cost. Most farmers who own small amount of land and do their own farming have to reduce production cost as much as possible and many of them may depend on credit providers. There are also vulnerable groups who make a living on employment for pesticide spraying and these people will not have any choice in selecting type of pesticides to be used. The Project should therefore provide support to the poor farmers and these vulnerable groups so that they can have access to safety equipments as well as have technical knowledge to choose the right chemical and/or adoption of the non-chemical practices. Training on safe use of pesticide should be given to these target groups and free health check up program should also be provided. Additional livelihood training could provide options for these people to improve their living conditions.
Section IV. Guideline for the Preparation of a Subproject specific IPM Program

28. To reduce the impacts on increased in pesticides and fertilizer uses due to the implementation of the Project, the project would support the preparation and implementation of the subproject specific IPM Program. The Subproject specific IPM Program would be prepared by the respective PPMUs with the assistance of technical experts/consultants in close consultation with the respective provincial DARDs, local farmers and research institutes. The plan will identify a clear target on the amount of fertilizers and toxic chemicals (pesticides, insecticides, herbicides) uses.

This section sets out the framework for the IPM Programs, including basic principles, scope of the IPM program, and the approval process. The IPM Program would be prepared for each of the subprojects included in the Project. At appraisal, three IPM Programs have been prepared. Additional technical guidelines in line with WB OP4.09 are provided in Section V.

4.1 Basic Principles

29. The following principles will be applied to all the subprojects that are likely to increase the use of fertilizer and pesticides:

a) As identified in the ESMF screening criteria, the Project will not finance procurement of large amount of pesticides. However, if serious infestation occurs in the area, procurement of small amount of pesticides could be carried out with support from the Project; Type of pesticides, procurement, storage, and transportation will be in accordance with the government regulation as described in Section II. WB no objection will be required before the procurement of such pesticide can take place.

b) *IPM program and Project support:* All subproject benefiting from the dredging and dyking works with support from the Project will develop and implement an IPM program as part of the EMP for the subproject. Project support will include technical assistance (consultants), safety equipment, materials necessary for implementation of non-chemical options, and support for priority extension services, including incremental operating cost. WB clearance for all the IPM program of the subprojects will be required either through a standalone document or as part of the EMP clearance. A budget of about $3 million has been allocated for implementation of the IPM programs for the Project areas. Detailed work plan will be finalized through close consultation with the farmers, local agencies, and local institutions/NGOs.

c) The Project will adopt an IPM approach as a mean to minimize the potential negative impacts due to potential increase in fertilizer and chemical uses. However, emphasis will be given to enhance knowledge and experience through in country study visit and training (courses and on-the-job) on safe selection and use of chemicals as well as on demonstration of various non-chemical options, especially the use of rice straw, organic wastes, and other techniques, being investigated and/or applied in Vietnam. Given that
many different people use IPM in a different ways, the Project will adopt the IPM approach and technical guidelines provided in Section V below.

d) The IPM program can be designed to support the implementation of the government agricultural production policies on “Three Reduction, Three Gains and/or One Must, Five Reduction” however the target should focus on reduction of fertilizer and pesticides uses.

e) Under normal condition, if pesticide usage is considered necessary as one of a necessary option, only the ones registered with the government and acceptable internationally will be used and the Project will also provide technical and economic justification (see guidelines in Section V) on the needs for such chemicals considering the options available for non-chemical pest management techniques that could also reduce reliance on synthetic chemical pesticides. Adequate measures will be incorporated in the project design to reduce risks associated with the handling and use of pesticides to a level that can be managed by the users.

f) Planning and implementation of regulatory measures and other complimentary actions will be made in close consultations with key agencies and stakeholders, including chemical suppliers, to facilitate their cooperation and understanding.

g) Implementation of the IPM programs will be closely monitored by CPMU with technical cooperation of PPD and other agencies and the results will be included in the Project progress report. At completion an impact assessment study will be independently carried out to validate actual achievement and impacts of the program and extract lessons learnt.

h) The Project will provide technical assistance comprising but not limited to, training, public outreach, and pilot activities that promote non-chemical agriculture as well as financial support for safety equipment and capacity building and training to the poor who will be the most affected by unsafe use of pesticides in exchange to their active participation in the IPM program, especially on monitoring and reporting on the amount of chemical used. TOR will be prepared for each technical assistance in consultation with concerned agencies and be sent to the Bank for review and comment.

4.2 Scope of an IPM Program

(a) Objective and Targets
30. Objective. The IPM program will be designed with an objective to reduce the use of fertilizer and chemicals in the subproject area with a clear performance target according to type and amount of chemical uses. The activities should be identified through consultation with farmer networks and local authorities building on the knowledge and experience gain in the areas and in line with the Government policy on “Three Reductions, Three Gain” and/or “Five Reduction and One Must Do”. However, given that pest management could be more effective if the issues are addressed in a broader context, it is anticipated that the public outreach and communication campaigns should cover the entire project areas starting first in five first cycle
subprojects: Bac Vam Nao (BVN), O Mon Xa No (OMXN), Quanlo-Phoung Hiep (QLPH), Dong Nang Ren (DNR). For the subproject area the baseline data on the fertilizer and agro-chemical uses will be established during the registration of participating farmers which is expected to be carried out during the finalization of the IPM as the first step for the implementation of PMF. Below provide specific target for the IPM program while the approach and key tasks are described in (b) and an estimated budget is provided in (c).

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<tr>
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<tbody>
<tr>
<td>Fertilizer</td>
<td>Conduct survey</td>
<td>10% of baseline</td>
<td>The area and target for IPM program will be determined through consultation with stakeholders</td>
</tr>
<tr>
<td>Pesticides (can be broken by type?)</td>
<td>Conduct survey</td>
<td>50% of baseline</td>
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(b) Key tasks and implementation approach.

31. The IPM program will comprise, but not limited to, the following tasks:

- **Task 0. Baseline Survey.** As the very first step, the baseline survey shall be conducted within the subproject area to assess the current usage of the pesticides and other agriculture chemicals, and identify the existing environmental and health conditions. The baseline survey should cover: (a) overall use of the chemicals (through rapid rural survey, including focus group discussion to identify the vulnerable groups), (b) measurement of the water quality through sample testing (at least two places), (c) identification of health issues. The baseline survey shall be presented to the farmer groups during implementation of Task 1 below.

- **Task 1. Farmer adoption of good IPM practices and safe use of pesticides:** This task will focus on strengthening capacity of farmer organization network on IPM to facilitate farmer adoption of good practices in various aspect of IPM approach and provide knowledge and assistance to farmers regarding safe use of pesticides when necessary. The activities will be built on previous IPM efforts, the GoV policy to reduce fertilizer and pesticides (3R3G), and current knowledge and available technology, and they will be developed and implemented in close cooperation with the extension services, local institutes, and with technical guidance of PPD. The extension staff and farmers (after training and with help from technical assistance under Task 2) will discuss the pest management situation in their own areas and identify good practices that could be adopted to ensure that pesticides are used only when necessary and they will be used safely. Due attention will be given to reduce the use of pesticides and fertilizer, increase the number of women participants, increase cost sharing of beneficiaries (especially those who are better off), and activities that could lead to sustainability of the farmer adoption. Reduction of 50 percent pesticide use and 10 percent fertilizer used should be considered as a minimum target for the IPM program. Indicators may include: reduction of pesticides and fertilizer use; increasing number of woman participation; increased knowledge on health and the environmental impacts; and increased cost sharing from beneficiaries.
Counterpart fund in the form of cash and in kind will be necessary to demonstrate GoV commitment to facilitate sustainability of the IPM efforts. The Project could support technical assistance, training, workshops, public awareness, and small investment on vehicles (motorcycles) and incremental operating costs. Training may include training courses, on-the-job training, and study visits while the public awareness and outreach materials could include effective media and other outreach instrument proven to be effective.

- **Task 2 Adoption of non-chemical uses and farmer outreach** Based on experience available in the country, a group of researchers, extension staff, decision makers, farmers and other stakeholders will prepare a short list of non-chemical options that are likely to be application in the project and/or subproject areas given local knowledge and culture. A work plan will be prepared comprising activities that could lead to an adoption of the technology within 2 years, including a research investigation as needed. Sharing of knowledge and experience to forge cooperation and facilitate understanding of farmers in the project area should be encouraged. When possible an incentive arrangement should also be considered to encourage farmers to adopt the practices in a longer term. Efforts should also be made to involve private sectors and other stakeholders. The Project could support technical assistance, training, workshops, public awareness, and small investment on necessary working equipment (such as motorcycles) and incremental operating costs. Training may include training courses, on-the-job training, and study visits while the public awareness and outreach materials could include effective media and other outreach instrument tools proven to be effective.

- **Task 3 Special assistance to poor farmers and vulnerable groups** This task aims to promote awareness of health risk related to pesticide uses by providing free health examination service (at least annually for two years) and access to safety equipment to poor farmers and those who are hired to spray pesticides and chemicals e.g. spraying workers. The process and mechanism for provide this assistance should be established by the IPM farmer organization through consultation among farmers and stakeholders. Eligible farmers should be identified through the registration process (see Section 4.3 below) and all of them must attend proper training on safe use of pesticides. Type and nature of equipment to be procured should be identified by PPPD and acceptable by the farmers. Distribution of the equipment could be made through lending (free or small amount of payment). Health examination and/or treatment (if needed) should be made by qualified specialists. The project could support technical assistance (consultant), equipment, workshops, and health service cost. Those who are negatively affected by the Project as well as ethnic minority will have high priority to benefit from this assistance.

- **Task 4 Strengthen regulatory measures** To compliment the activities described above, the IPM program will identify regulatory measures, including monitoring, training, and outreach, to ensure appropriate control of pesticides suppliers and fertilizers. All the suppliers and retailers in the project areas should be registered and training should also be provided to them to ensure that they are aware of the GOV regulations, understand the toxicity of pesticides and its consequence to the human health and local environment, and build their cooperate social responsibility (CSR). Efforts should also been made to seek
cooperation of chemical suppliers to promote the use of non-toxic chemicals, and organic materials as well as to provide correct information to farmers in their advertisement. Scope of the activities discussed in Sections 3.4 and 4.1 above should also be considered. The Project could support technical assistance, training, workshops, equipment, and laboratory analysis cost. The training and public awareness and outreach materials could include effective media and other outreach instrument proven to be effective.

4.3 Planning and Implementation

(a) Key Steps

32. It is anticipated that technical assistance will be acquired to assist in the planning and implementation of the IPM programs and the activities will be implemented through the following steps:

- **Step 1**: Setting up baseline and farmer registration. This step should be made as soon as possible. Appropriate questionnaires will be developed to establish the 2011 baseline or later year depending on when the subproject is confirmed for implementation for fertilizer and pesticide use in the subproject areas. Consultation with key agencies and training and registration of farmers will be conducted.

- **Step 2**: Setting up program target and work plan preparation. Based on the results from the questionnaires and consultation in Step 1, the work plan and schedule will be prepared, including budget and the implementing entities. The work plan will be submitted to CPMU for approval and to WB for review and comment.

- **Step 3**: Implementation and annual monitoring. After approval of the work plan, activities will be implemented. The implementation progress will be included in the Project progress report. An annual evaluation will be made by CPMU and PPD.

- **Step 4**: Impact evaluation. An independent consultant will be hired to conduct the impacts assessment. This is to assess performance of the project and extract lessons learnt. PPMU/PMU10 will hire a national consultant to carry out an impact assessment of the IPM program. TOR for the assessment will be sent to WB for comment before commencement of the assignment.

(b) Guidelines towards Budget Estimation

33. **Technical Experts.** It is anticipated that at least two groups of technical experts would be needed. The first group will assist PPMU in preparing and implementing the above-mentioned Step 1, 2, and 3, namely the establishment of baseline, preparation of the work plan in consultation with farmers/networks, and forge effective implementation of the IPM program.
The consultants will also assist the PPMU in providing training and facilitating workshops for the farmers as well as conducting procurement of safety equipment and public outreach activities, including a public health checkup which will be free to the poor and vulnerable groups. The second group will be hired for Step 4 at the end of the IPM program to conduct an impact assessment survey so that a report could be submitted within 3 months after completion of the IPM for the subproject and/or Project area. Below provides an indicative budget line.

- Safety equipment ($30/unit, 10,000 units for lending/renting)
- Public Outreach and health check
- Training of farmers and suppliers/traders
- Demonstration
- Residual pesticide testing and monitoring
- Equipment and motorcycle
- IOC
- Technical Experts

- Total

(c) Consultation and Finalization of IPM Program

34. In preparing the IPM Program, the PPMUs shall carry out extensive consultations with the following key stakeholders: (a) Agriculture Extension offices under provincial DARDs and staff at commune and village level; (b) farmers and mass organizations including its associations; and (c) local institutes. The IPM Program shall also summarize the outcome of the discussions and present the broad support from above-mentioned stakeholders.

4.4 Review, Approval, and Reporting

35. The IPM program for each subproject will be reviewed by the PPD to ensure that it is in line with the PMF and that the budget and eligibility is in accordance with the various Project agreements. The CPMU shall submit the final IPM Program as part of the subproject EMP to the Bank for approval. During implementation, progress report will be provided as agreed with CPMU. The progress report should update the implementation progress, key findings and recommendations regarding the implementation of the activities, including difficulties encountered and suggested solutions. It also should present the plan of activities for the next reporting period including expected output.
4.5 Outline of the IPM Report

35. Below provide a sample outline for the IPM report:

Contents

Executive summary

1. Introduction — briefly describe the background and connection of this IPM program with other safeguard documents as appropriate (PMP/ESMF, RPF, EMPD, etc.) as well as a list of GOV regulations that will be used as the basis for the IPM implementation. It should also state the objective of the program in the subproject specific area.

2. Pesticides Management and IPM Practices in the Project/Subproject Area — this section should present current and anticipated pest problems in the area as well as type and amount of pesticides uses (without the Project); Current and proposed pest management practices (with the Project but without IPM implementation); and the situation with the mitigation measures (with IPM implementation); and capacity of agency/farmer to implement the IPM program.

3. Pesticides Management and IPM Program to be implemented in the project/subprojects — this section should describe the program/activities prepared according to the PMP and after consultation with farmers and stakeholders. It is important to establish a baseline and a clear target and monitoring indicators. If the project will be used to procure pesticide, technical and economic justification including a list of pesticides will also be provided.

4. Implementation arrangement, including M/E, budget and schedule — this section should provide information on work schedule and budget as well as the entity who will implement the activities and their capacity and readiness. Government contribution (cash and in kind) to the program should also be recorded.

Annexes — there should be at least one annex summarizing result of consultations and concerns expressed by farmers and/or stakeholders including a list of participant and/or other individual.

Section V Supplementary Guidelines for Preparation of an IPM Program

36. To be in line with OP 4.09 the following principles on IPM, technical consideration, technical and economic justifications, and list of prohibited pesticides and/or chemicals should be applied and/or considered:

\[\text{WB guidelines — reference in internet}\]
5.1 General IPM Principles

- "Grow a healthy crop. The focus is on cultural practices aimed at keeping the crop healthy. Selection of varieties that are resistant or tolerant to pests is an important aspect. Attention to soil, nutrient and water management is part of growing a healthy crop. Many IPM programs therefore adopt a holistic approach and consider a wider range of agro-ecological parameters related to crop production.

- Manage the agro-ecosystem in such a way that pests remain below economic damaging levels, rather than attempt to eradicate the pest. Prevention of pest build up and encouragement of natural mortality of the pest is the first line of defense to protect the crop. Non-chemical practices are used to make the field and the crop inhospitable to the insect pest species and hospitable to their natural enemies, and to prevent conditions favourable to the build up of weeds and diseases. Decisions to apply external inputs as supplementary controls are made locally, are based on monitoring of pest incidence and are site-specific. External inputs may include predators or parasites (bio-control), labour to remove the pest manually, pest attracting lures, pest traps, or pesticides. The choice of external input varies for each situation. Pesticides are generally used if economically viable non-chemical pest control inputs are not available or failed to control the pest. They are applied only when field monitoring shows that a pest population has reached a level that is likely to cause significant economic damage and the use of pesticides is cost-effective in terms of having a positive effect on net farm profits. Selection of products and application techniques should aim to minimize adverse effects on non-target species, people and the environment."

5.2 Technical Consideration for an IPM Program

37. Below provides technical guidelines for consideration during the finalization and implementation of the IPM program for the subprojects and it should be used to guide the training for extension staff and farmers.\(^{10}\)

- IPM is not an input or a technology but an approach that should be applied according to the local conditions. IPM encourages farmers to find specific solutions to the pest problems they encounter in their fields based on understanding of agro-ecological principles, monitoring interactions among crops, pests and natural enemies of pests, and selecting and implementation of adequate control measures.

- In addition to crop production, IPM also calls for non-chemical alternatives to post harvest loss prevention. This is particularly important as losses due to post harvest

\(^{10}\) See original in WB internet regarding pest management policy.
damage can be significant and use of chemicals on stored produce is a common cause of poisoning people.

- **Support for IPM extension and farmer training** should be the core element of an IPM program, however it should be designed to connect with existing capacity and organization structure and cropping systems. Increasing knowledge and skills of farmers may be conducted through a variety of measures, including but not limited to: (a) demonstration plots and trials as traditionally known in agricultural extension, (b) distribution of information via television and radio broadcast, newsletter, and internet services; and training of individual farmers or in groups. Application of the Farmer Field School (FFS approach and/or the Farmer Participatory Training and Research (FPTR) approach (as promoted by CABI and others) may be applied as appropriate. International and national agricultural research centers are using FPTR to bridge the gap between research and implementation by farmers.

- **Outreach and sharing of experience** is also a critical element of the IPM approach. The program should be designed to increase knowledge on good practices that are likely to be practical in the projects/subprojects areas taken into account the socioeconomic conditions of farmers. IPM does not necessarily involve sophisticated information gathering and decision making. The IPM approach can be introduced at any level of agricultural development. For example, improvement of basic crop management practices, such as planting time and crop spacing, can often be effective in reducing pest attack. IPM is a dynamic process. A useful beginning can be made with relatively limited specialized information or management input. Later, additional information, technologies, and mechanisms can be developed to enhance the effectiveness of the system.

- **Research and development and technical assistance:** There is no "blueprint" for planning interventions in support of IPM in a particular setting. The on-going research, extension activities, and training to staff and farmers related to IPM in the fields should be reviewed and if found appropriate the IPM program for the subproject should be built on the strength and address the weaknesses. When possible, providing support to research is an important element of an IPM intervention strategy because there is still a lack of locally adapted solutions to pest problems. Additionally, new pests constantly emerge with the change of farming systems. Close relationship between the research and extension services must be ensured. Involvement with the private sector to promote non-chemical and/or "green and safe" IPM options should also be considered.

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11 The concept of FFS comprises usually a season-long group training exercise for a group of farmers in an on-site location. Emphasis is put on agro-ecosystem analysis as a way to acquire environmental management knowledge in learning by doing approach. FFS have been used in many Asian countries to address pest problems caused by injudicious and over use of insecticides, especially in irrigated rice. The approach has been promoted by the Systemwide Programme on IPM (SP-IPM) which is based at FAO and supported by the Bank. In Vietnam, it is not clear about the economic impact and the financial sustainability of the FFS concept as costs per trained farmer can be substantial.
There is a wide variety of techniques that can be applied under IPM approach. Applicability of individual techniques depends on various factors, including: the crop, the cropping system, the pest problems, the climate, the agro-ecological conditions, etc. Generally, IPM involves a combination of techniques. Some examples of such techniques include:

- Cultural practices that can help prevent build up of pests such as Crop rotation, Inter-cropping, Field sanitation and seed bed sanitation, Use of pest-resistant crop varieties, Managing sowing, planting or harvesting dates, Water/irrigation management, Soil and nutrient management (including mulching, zero/low tillage, fertilizer management), Practices to enhance the build up of naturally existing predator populations, Hand-picking of pests or hand-weeding, Use of traps or trap crops, and Post harvest loss prevention;
- Biological inputs -include Biological control through release of predators, parasites or pathogens; Biological control through fish, ducks, geese, goats, etc.; Release of sterile male insects; Bio-pesticides; and Biological preparations (e.g. name extract).
- Chemical inputs such as Chemicals that disrupt insect behavior (e.g.: pheromones) and Growth-regulators.
- Conventional pesticides: The use should be technically and economically justified (see Section 5.3 below)

Careful selection of pesticides and application techniques is important to minimize impact on beneficial organisms, humans and the environment. There is a broad range of pesticides with varying degree of impact on beneficial organisms, humans and the environment. When selecting pesticides one would search for a product that: (a) is effective in controlling the pest; (b) is highly specific to the pest and does not significantly affect beneficial organisms; (c) has a low human toxicity. In addition it is important to look at applications methods, as the amount of pesticides used may vary significantly. Use of insect traps (attractant combined with a pesticide) for instance requires far less pesticides than foliar application of pesticides onto crops.

5.3 Determining Justification for Pesticides Use

38. Technical and economic justification should be used to determine the need for use of pesticides. The following checklists provide some guidance in determining the extent to which pesticide use is technically and economically justified under an IPM approach. It should be seen as a score card rather than a list of prerequisites that all should be met.

- Technical Justification: Example of positive criteria indicating that pesticide use is in line with IPM principles include
  - Users are aware of non-chemical techniques to prevent or control pests, and understand the ecological, health and economic risks of pesticide use;
  - Various non-chemical methods of agro-ecosystem management are used to keep pest populations low; preventing pests and diseases is a major element of the strategy;
- Decisions to apply external inputs as supplementary control are made locally, are based on monitoring of pest incidence and are site-specific (as opposed to centrally issued blanket instructions);
- Selection of pest control inputs is based on minimizing negative impact on the agro-ecosystem. Use of non-conventional pest control inputs (biological control, bio-pesticides, growth regulators, pheromones, etc.) is considered before considering application of conventional pesticides;
- Judicious and selective use of pesticides is employed only when other economically viable alternatives are not available, when damage or loss levels are exceeding thresholds and other control methods have failed;
- Application techniques are selected that minimize impact on the agro-ecosystem;
- Use of pesticides is economically justifiable in terms of having a positive effect on net farm profits that is not offset by increased short and long term risks to health, environment or profit; and
- Compared to present practices, proposed pesticide use diminishes the social costs of pesticide use (negative externalities such as environmental and health costs).

Examples of negative criteria indicating that pesticides use is most probably not in line with IPM principles:
- Single or primary focus on use of pesticides for pest management (including weed or rodent control);
- Pest control schemes based on calendar spraying, or other use of pesticides without use of Economic Threshold Levels (ETLs) and scouting/monitoring;
- Input packages or rural credit packages that obligate inclusion of chemical pest control (and therefore assume that they are needed regardless of the actual field situation);
- Centrally designed pest control schemes that do not, or cannot, take into account local conditions and seasonal variations;
- Pesticide use likely to lead to long term path dependency, pest resurgence, secondary pest outbreaks or pest resistance;
- Farmers are not involved in taking decisions to apply pesticides;
- Free or subsidized distribution of pesticides;
- Use of persistent and/or non-selective pesticides, such as broad-spectrum pesticides or products combining various active ingredients, that significantly affect non-target organisms and reduce the natural control capacity of the agro-ecosystem;
- Absence of economic analysis demonstrating positive impact of pesticide use on farmers' net incomes;
- Absence of evidence demonstrating cost-effectiveness in terms of public health gains for pesticides used in disease vector control;
- Social costs to the public in the form of environmental contamination and health risks; and
- Advisory services with a commercial interest in pesticide sales.
**Economic justification.** Calculation/assessment of true cost of proposed pest control should be made as follows:

- **Obvious private costs at the user's level.** This should include Cost of pesticides (farm gate price), Farmer's cost of transport, storage and disposal; Cost of application (hired labour, opportunity cost of family labour, spraying equipment); and Cost of protective gear and other risk reduction measures.

- **Hidden private costs.** This should include Acute and chronic health effects of pesticide poisoning (medical treatment, labour productivity loss); Reduction of beneficial organisms and other functions of the agro-ecosystem; On-farm pest resistance build-up; On-farm production loss due to negative side effects (crop damage due to pesticide drift, losses in animal, honey bee, fish production); and Decreased marketability of produce due to high pesticide residue levels.

- **External costs should include Health damage to the public through consumption of pesticide; residues and exposure to contaminated material; Damage to natural resources (ground and surface water, natural habitats, biodiversity); Off-farm losses in crop and animal production; Costs of preventative measures to avoid damage (e.g. residue monitoring and control in food and water, avoidance of pesticide contamination); and Regulatory control (pesticide registration, monitoring and law enforcement).**

**Determining economic damage.** Damage should be measured in terms of impact on farmer's net profits rather than impact on yield. The risks and cost of preventing yield losses should always be balanced against the value of crop to be saved. Decisions to apply pesticides are based on assessment of the expected economic damage and the cost and effectiveness of control. A commonly used instrument for such assessment is the Economic Threshold Level (ETL). ETLs vary for each situation and are determined through crop-loss assessment taking into account a variety of factors, including the value of the crop, the amount of damage it can tolerate at each growth stage without significant effect on yield, and the cost of crop protection measures (e.g.: price of pesticides, application equipment and protective gear), and takes into consideration the risk that chemical control could induce further pest problems. ETLs are often established to move away from preventative calendar application. Much IPM research focused on establishing ETLs and many of the initiatives of the agro-chemical industry to rationalize pesticide use are based on the introduction of ETLs. Although ETLs have been an important element of IPM, it should be emphasized that their use alone does not convert conventional pest management into IPM. Essential to IPM is strategic agro-ecosystem management to prevent the build up of pest problems in the first place. A focus on ETL-based pesticide applications does not take into account the cause of the pest problem, which often lies in poor management of the cropping system.

**5.4 List of Prohibited Chemicals**

Below provided a list of banned chemicals
o **Chemicals under Stockholm convention** are listed as follows: Annex A: aldrin; chlordane; dieldrin; endrin; heptachlor; hexachlorobenzene; mirex; toxaphene; and polychlorinated biphenyls (PCB).

o **Chemicals according to the Rotterdam Convention are listed as follows:**
  - Pesticides are 2,4,5-T; aldrin; captafol; chlordane; chloridimeform; chlorobenzilate; DDT; dieldrin; dinoseb and dinoseb salts; 1,2-dibromoethane (EDB); fluroacetamide; HCH (mixed isomers); heptachlor; hexachlorobenzene; lindane; certain mercury compounds; and pentachlorophenol.
  - Certain hazardous pesticide formulations of methamidophos; methyl-parathion; monocrotophos; phosphamidon; and parathion.
  - Industrial chemicals are asbestos (crocidolite); polybrominated biphenyls (PBBs); polychlorinated byphenyls (PCBs); polychlorinated terphenyls (PCTs); and tris (2,3-dibromopropyl) phosphate.
  - Recently added chemicals include pesticides binapacryl; toxaphene; ethylene dichloride; ethylene oxide; and DNOC and its salts.
  - All formulations of monocrotophos and parathion and Certain formulations of benomyl, carbofuran and Thiram.
  - Industrial chemicals asbestos (actinolite, anthophyllite, amosite, tremolite); Tetraethyl and tetramethyl lead.

40. Addition source of information: Below provides examples of important ongoing international IPM research programs:

- The System-Wide Program of the CGIAR (SP-IPM) bundles activities in international and national research centers according to the specific thematic focus (see [http://www.spipm.cgiar.org/](http://www.spipm.cgiar.org/)).
- The IPM Collaborative Research Support Program of US universities with counterpart researchers in a number of developing countries, supported by USAID, focuses on the pest management problems of horticultural export crops, peri-urban vegetables, olives, and some staple crops.
- CABI has a long record for developing biocontrol techniques and IPM approaches for many location specific pest problems (see [http://www.cabi.org/](http://www.cabi.org/)).
- International Centre of Insect Physiology and Ecology is a leading research center in insect ecology and runs field research programs which include many horticultural crops (see [http://www.icipe.org/](http://www.icipe.org/)).

Section VI. Proposed Studies for the Aquaculture in the Project Area

41. The proposed project would not aim at conversion of the aquaculture activities in the project area. The project areas do not include coastal areas where exclusive shrimp aquaculture is carried out. The five Cycle 1 subprojects are located inland, and do not contain large areas of
Pest Management Framework (PMF)
Mekong Delta Water Management for Rural Development Project

aquaculture. However, subprojects for Cycles 2 and 3 may include the areas in lower Mekong Delta where extensive shrimp aquaculture farms, mostly integrated with rice farm. This integrated rice-shrimp aquaculture is widely adopted throughout the saline affected areas in the Mekong Delta.

42. The infrastructure works proposed for the project such as dredging would certainly stabilize the availability of the fresh water. The construction of the secondary and tertiary sluice gates would also enable more subtle control of the salinity and provide aquaculture farmers with reliable access to brackish water. Driven by the lucrative market, it is expected that the aquaculture farms would continue to increase in the future. Therefore, it is also important for the project to consider the environmental aspects of the shrimp aquaculture.

43. The integrated rice-shrimp aquaculture in the Mekong Delta is considered to be one of the most ecologically sustainable approaches to shrimp aquaculture. Most of the aquaculture farms are of small scale (typically up to 100 - 300 m2) run by families. The typical annual crop cycle is one (or two) shrimps and one rice production. While in early 2000s, some farmers use domesticated shrimps, using a hatchery raised post larvae of *P. monodon* is becoming a common practice as the quality of the post larvae has improved. The rice-shrimp aquaculture has been carried out through modification of the existing rice field; therefore, there is no impingement with the mangrove forest. The intensity of the aquaculture is quite low (4-6 shrimps per m2, 300-400 kg per ha on average) and feed input is also relatively low. The freshwater rice crop provides a buffer between the brackish water shrimp crops; therefore inundation of saline water during the dry season apparently does not lead the salinization of the soil. Residual organic materials from shrimp aquaculture appear to be used as fertilizer for rice farming.

44. It is also apparent that the rice-shrimp farming system provides farmers with relatively better financial security than alternative extensive monoculture systems. A characteristic of the rice-shrimp farming system, is that the wet season rice farming provide food security for the farm household, and dry season shrimp farming providing cash income. Relatively low labor intensity of the farming practice allows family members to work off farm, further adding to household income. The current trend is to shift from shrimp monoculture to integrated rice-shrimp aquaculture.

45. Nevertheless, there are some environmental concerns on the current rice-shrimp farming systems. First, the current shrimp farming method is based on the high water exchange, which would result in high accumulation of the sediment in the rice farms in the long-term. Many farmers reportedly dispose accumulated sediment back in the canals or nearby river, which would induce negative environmental impacts. Further, high water exchange system would also lead to more effluent of the waste water from the shrimp farming.

46. In this context, the Project would support a study contributing to the improvement of the current water management for shrimp aquaculture. In particular, the study would cover the following aspects;
Pest Management Framework (PMF)
Mekong Delta Water Management for Rural Development Project

- Developing a current inventory on the integrated rice-shrimp farming. The inventory would cover the following aspects: (a) size, (b) ownership, and (c) history of the current rice-shrimp farms in the following provinces: (i) Ca Mau, (ii) Bac Lieu, and (iii) Soc Trang;
- Analyze the typical use of the chemicals such as: (a) fertilizer, (b) pesticide and herbicide, and (c) antibiotics, and measure water quality in a few typical farms;
- Identify the areas of environmental concerns (sediment and water quality) and develop an environmental monitoring plan during the project implementation period;
- Explore the best practices to reduce the use of chemicals and develop a plan to disseminate them through a pilot program to be supported under Component 1.
PDO:

The proposed project development objective (PDO) is to protect and enhance the utilization of water resources in the Mekong Delta. In doing so, it will help to sustain prior gains in agricultural productivity, provide access to water supply for rural households, and contribute to climate change adaptation.

Components:

The project would be comprised of the following four components:

**Component 1: Water Management Planning and Efficient Utilization (US$ 12.9 million):**

The main objectives of this component are to strengthen the water resources management planning capacity at the regional and provincial levels and increase efficiency in the utilization of water. The component would include the following activities:

A. Water Management Monitoring and Investment Planning in the Western Mekong Delta, aiming at adjustment of the existing provincial water management plan prepared based on the Mekong Delta Master Plan, incorporating potential impacts from upstream development and climate change. The output of this subcomponent would include: (a) preparation of revised provincial water management and investment plans, and (b) development of a regional water analysis framework based on information from the concerned provinces.

B. Water Productivity, Operation and Maintenance: promoting the efficient use of the water through demonstration of good practices of on-farm water and agriculture management to increase water productivity, and increased efficiency in the operation and maintenance of the irrigation schemes supported by Component 2. This subcomponent would comprise the following activities: (a) Pilot On-farm Management for Improved Water Productivity in (i) An Giang (extensive rice cultivation), (ii) Can Tho Municipality (rice cultivation and fruit trees), (iii) Hau Giang (rice cultivation and fresh-water aquaculture), and (iv) Bac Lieu/Ca Mau (combined rice cultivation and saline or brackish-water aquaculture), and (b) Support for Operations and Maintenance aiming at support for (i) the seven (7) IDMCs in the project provinces (designing for Surveillance, Control and Data Analysis (SCADA) system, preparation of business plans and logistical support), and (ii) WUOs (establishment of 75 WUOs, initial training and on-farm support) mainly within the irrigation schemes under Component 2 subprojects would be carried out with priority focus on the first three cycle 1 subprojects as pilot.

**Component 2: Improvement and Rehabilitation of Water Resources Infrastructure (US$ 143.0 million).** This component would support the improvement and rehabilitation of water resources in selected water management schemes. The works would include: (a) major maintenance of existing under-performing infrastructure (e.g., canal dredging, re-sectioning...
and lining repairs, and rehabilitation of dykes), (b) completion and/or minor upgrading of existing infrastructure (construction of secondary and tertiary sluices gates, construction of small bridges, upgrading dykes), and (c) rehabilitation of the tertiary and quaternary irrigation facilities in conjunction with the activities to establish WUOs under Component 1, and (d) installation of the SCADA system in conjunction with the support provided to IDMCs under Component 1. This component will be implemented through a three cycle subproject approach. During project preparation, the five first cycle sub-projects (with investments totaling approximately US$ 63.0 million) have been identified as first year subprojects and fully prepared with detailed designs and safeguards. Other subprojects have been identified yet more detailed design work would be completed during the period of project implementation itself.

This component would include facilities to support civil works such as: (i) feasibility studies and safeguard documents, (ii) detailed design, (iii) environmental and safeguard monitoring, and (iv) support for implementing integrated pest management. The cost for land appropriation, estimated at US$18.9 million, would be exclusively financed by the Government. Second and third cycle subprojects would be implemented starting March 2012 and May 2014 respectively. Prior to commencement of the second and third cycle subprojects, feasibility studies and safeguard documents would be sent to the Bank for review and approval.

Component 3: Rural Water Supply and Sanitation (US$45.0 million). Activities will include upgrading and construction of small piped rural water supply systems in the seven project provinces/municipalities benefitting about 60,000 households. This Component would include the following subcomponents: (a) support for rural water supply infrastructure, and (b) provision of sanitation facilities to about 15,000 households and 35 public schools. Similar to Component 2, this component would also be implemented through a three cycle subproject approach, and two subprojects have been fully designed for the first cycle. Timing of the second and third cycles would be the same as for Component 2 and prior to commencement of second and third cycle subprojects, feasibility studies and safeguard documents would be sent to the Bank for review and approval.

Component 4: Project Management and Implementation Support (US$6.6 million). This component would support the incremental operating costs and logistical support for the Central Project Management Unit (CPMU), Project Management Unit no.#10 (PMU10), Provincial Project Management Units (PPMUs), and Provincial Center for Rural Water Supply and Sanitation (PCERWASSs). The Government will finance: (a) project staff and associated per diems, (b) office space, (c) fuel and (d) utilities, whereas the Bank’s funds would be used to finance: (a) office furniture, (b) logistical support (vehicles), (c) office supplies and (d) communications and logistic maintenance.

Project areas and subprojects:

The Project areas will cover the western part of Mekong Delta of the six provinces (An Giang, Kien Giang, Ca Mau, Hau Giang, Bac Lieu, and Soc Trang) and Can Tho Municipality. While
the water supply subprojects (Component 3) will be carried out in various locations most of the subprojects related to irrigation and flood control will be carried out in the following existing irrigation/flood control areas:

- **O Mon-Xa No (OMXN):** About 2-4 subprojects will be located in this area of which the first subproject would cover construction of 99 secondary and tertiary sluices, reinforcement 16 km of Xa No dike, and installation of SCADA system. Other subproject will be implemented during the second and third subproject cycles and main activities will cover dredging and dyking of existing primary and secondary canals, including construction of 1-2 bridges nearby the area.

- **Bac Vam Nao (BVN):** There will be one subproject involving dredging of existing secondary canals (735 km); installation of 297 small sluices; and construction of about 800 km of rural roads to facilitate modernization. This will be implemented in the first subproject cycle starting 2011.

- **Quan Lo-Phung Hiep (QLPH):** There will be 1-3 subprojects involving dredging, diking, and/or construction of secondary sluices and rural bridges and 2-3 subprojects involving construction of about 70 small and medium size bridges in Soc Trang and Bac Lieu. Two bridge construction subprojects have been proposed for the first subproject cycle.

- **Dong Nang Ren (DNR):** One subproject involving dredging, dying, and construction of secondary sluices and bridges and this will be implemented in the first subproject cycle starting 2011; and

- **Ca Mau:** 1-2 subprojects will be proposed of which main activities would also cover dredging and diking of existing canals and construction of secondary sluice gates.
Table below summarizes samples information regarding types of pests, pesticides used, and efficiency of IPM practices in Bac Lieu province.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Total area affected (ha)</th>
<th>Types of pesticides</th>
<th>Dosage (L, kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter - Spring:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown rice backed hoppers</td>
<td>46,300</td>
<td>Buprofezin, Fenobucarb, Chlorpyrifos Ethyl + Cypermethrin, Chlorfluazuron + Fipronil, Abamectin, Fipronil, Imidacloprid.</td>
<td>0.3-2</td>
</tr>
<tr>
<td>Rice leaf folder</td>
<td>15,230</td>
<td>Chlorpyrifos Ethyl + Cypermethrin, Chlorfluazuron + Fipronil, Abamectin, Imidacloprid.</td>
<td>0.2-0.5</td>
</tr>
<tr>
<td>Rice thrips,</td>
<td>10,018</td>
<td>Fipronil, Daisies Herbal, Chlorpyrifos Ethyl</td>
<td>0.3-0.7</td>
</tr>
<tr>
<td>Rice leaf blast disease</td>
<td>24,365</td>
<td>Tricyclazole</td>
<td>0.3-1</td>
</tr>
<tr>
<td>Rice blast disease</td>
<td>11,275</td>
<td>Tricyclazole</td>
<td>0.3-1</td>
</tr>
<tr>
<td>OPV disease</td>
<td>26,290</td>
<td>Metaldehyde, Saponin</td>
<td>0.3-15</td>
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<tr>
<td>Chây bia lá</td>
<td>18.477</td>
<td>Kasumin</td>
<td>0.5-1</td>
</tr>
<tr>
<td>- Bệnh khó văn</td>
<td>17,105</td>
<td>Validamycin</td>
<td>0.3-1.5</td>
</tr>
<tr>
<td>- Khô đầu lá</td>
<td>10,440</td>
<td>Propiconazole</td>
<td>0.3</td>
</tr>
</tbody>
</table>
### Efficiency of IPM for 1 rice crop:

<table>
<thead>
<tr>
<th>TT</th>
<th>Criteria</th>
<th>Unit</th>
<th>Rice crop with IPM</th>
<th>Farmer’s rice crop (FP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seed</td>
<td>(kg/ha)</td>
<td>148.5</td>
<td>189.0</td>
</tr>
<tr>
<td>2</td>
<td>Fertilizer</td>
<td>(kg/ha)</td>
<td>303.0</td>
<td>340.0</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>(kg/ha)</td>
<td>132.0</td>
<td>165.0</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>(kg/ha)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>(kg/ha)</td>
<td>71.0</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>Seper N</td>
<td>(kg/ha)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>Pesticides</td>
<td>(time/crop)</td>
<td>3.6</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>For Brown rice backed hoppers</td>
<td>(time/crop)</td>
<td>1.1</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>For disease</td>
<td>(time/crop)</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>For weeds</td>
<td>(time/crop)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>Cost for Pesticides</td>
<td>VND/ha</td>
<td>2,592,000</td>
<td>3,202,000</td>
</tr>
<tr>
<td>5</td>
<td>Cost for Fertilizer</td>
<td>VND/ha</td>
<td>2,707,000</td>
<td>2,944,000</td>
</tr>
<tr>
<td>6</td>
<td>Average yield</td>
<td>(kg/ha)</td>
<td>5,500</td>
<td>5,300</td>
</tr>
<tr>
<td>7</td>
<td>Total revenue</td>
<td>VND/ha</td>
<td>33,000,000</td>
<td>31,800,000</td>
</tr>
<tr>
<td>8</td>
<td>Total payment</td>
<td>VND/ha</td>
<td>14,640,000</td>
<td>15,741,000</td>
</tr>
<tr>
<td>9</td>
<td>Interest</td>
<td>VND/ha</td>
<td>18,360,000</td>
<td>16,059,000</td>
</tr>
<tr>
<td>10</td>
<td>Balance between IPM and FP</td>
<td>VND/ha</td>
<td>2,301,000</td>
<td></td>
</tr>
</tbody>
</table>
Annex 3
Procedures for Transportation, Storage, and Uses of Pesticides

(a) Procedures for Safety transporting pesticides:

The following procedures will be followed while transporting pesticides for application under this PMP:
- pesticide concentrate will only be carried in a secure lockable and compartment with proper signage
- pesticide concentrate will only be transported in original labeled containers
- pesticide concentrate will always be carried separately from food and drinking water, safety gear and people
- spill-containment and clean up equipment will be carried separately from pesticides but in close proximity to the pesticide on each vehicle during pesticide transport and use
- appropriate documents such as operations records and material safety data sheets (MSDS) will be carried in each vehicle during pesticide transport and use

(b) Procedures for Safety storing pesticides:

In summary, the storage area must:
- be ventilated to the outside atmosphere
- be locked when left unattended;
- be entered only by persons who are authorized to do so
- have a placard affixed and maintained on the outside of each door leading into the facility in which the pesticides are stored bearing, in block letters that are clearly visible, the words “WARNING – CHEMICAL STORAGE – AUTHORIZED PERSONS ONLY”

In addition, the person responsible for the storage area shall notify the closest fire department of the presence of pesticides on the premises, if stored in one place for a period longer than 60 days. Persons responsible for the pesticide storage shall ensure that all pesticides are stored in a locked canopy, or similar arrangement, separate from the driver and personal protective equipment.

(c) Procedures for Safety Mixing, Loading and applying pesticides:

All mixing, loading and applicators of pesticides shall be carried out by certified pesticide applicators, or someone under the direct supervision a certified pesticide applicator in the appropriate category of certification.
- Mixing of pesticides must always be conducted in a safe manner
- Safety spill kits, spill response plans and first aid supplies shall be present on or near the treatment and mixing sites
- Eye wash station(s) and protective clothing as recommended on the respective product labels shall be available on or near the treatment and mixing sites.
- Product labels and Material Safety Data Sheets will be available on or near the treatment and mixing sites to ensure that quantities of pesticides being mixed and used are consistent with label rates
Pest Management Framework (PMF)
Mekong Delta Water Management for Rural Development Project

- There shall be no mixing or loading of pesticides within 15 metres of sensitive environmental features.

(d) Procedures for the Safe Disposal of Empty Pesticide Containers and Unused pesticides

Empty containers shall be disposed of in accordance with the manufacturer's instructions as noted on the product label or provincial instructions and recommendations.
As a minimum, empty pesticide containers shall be:
- returned to the pesticide distributor as part of their recycling program; or
- triple rinsed or pressure rinsed, then altered so they cannot be reused; and
- disposed of in a permitted sanitary landfill or other approval disposal site.

(e) Procedures for Responding to Pesticide spills

Spill treatment equipment shall be at or near storage (including mobile storage), mixing and loading sites, and it shall include at least the following:
- personal protective equipment
- absorbent material such as sawdust, sand, activated charcoal, vermiculite, dry coarse clay, kitty litter or commercial absorbent
- neutralizing material such as lime, chlorine bleach or washing soda; and
- long handled broom, shovel, and waste-receiving container with lid.

The following procedures must be followed if a spill occurs:
- all personnel shall be protected from pesticide contamination by wearing appropriate protective clothing and safety gear;
- any person exposed to a pesticide shall be moved away from the place of the spill
- first aid should be administered, if required
- the source of the spill should be stopped
- the spilled material should be stopped from spreading by creating a dam or ridge
- the owner shall ensure operations cease until the spill is contained and the source is repaired;
- absorbent material shall be spread over the spill, if applicable, to absorb any liquid;
- the absorbent material shall be collected in garbage bags or containers with the contents clearly marked
- contaminated soil or other material will be removed from the spill site and placed in garbage bags or containers
- the owner shall contact an approved representative of the province for shipping instructions and disposal requirements
- when more than one kilogram of product of pesticide is spilled, or any amount into a water body, the owner will immediately report it to the Provincial Emergency Program by telephoning 115 or, where that is impractical, to the local police; and
- an approved representative of PPD will be notified of the details related to the spill as soon as is practical by the owner.
Pest Management Framework (PMF)

Mekong Delta Water Management for Rural Development Project
Annex 4:  
Brief Overview of Aquaculture Practices in Mekong Delta

Current situation

In the Mekong Delta, catfish farm and shrimp farms are the major aquaculture. Catfish farming is conducted in freshwater area such as Bac Yam Noa in An Giang Province while shrimp farming is conducted along coastal area mostly in Ca Mau Province. Catfish production is about 1 million ton/year and most of them apply intensive farming and lime is normally used as well as other chemicals to disinfect water and sediment. Water pollution occurs due to the need to exchange water between fish ponds and canals every day, but so far the problems have not been serious. There are some research on design of water treatment but has not been applied due to the lack of investment cost.

Shrimp production in the Mekong Delta is about 300,000 tons/year and most of the farms are located in Ca Mau Province. About 10% of the total area of shrimp farming (about 400,000 ha) applies intensive farming (stock 20-30 PL/m2) and 90% applies an improved extensive farming (3-4 PL/m2). In general, shrimp farming in Ca Mau area has a long history. In the past (15 years ago), shrimp farming (mostly extensive) focused only along the coast but the culture area was extended landward starting in year 2000 after the Government permits farmers to grow shrimp. In 2007 most of the farms failed due to disease outbreak and most of the soil has been contaminated with saline water and this make it difficult for some area to adopt rice-fish model in Ca Mau area. In other upstream area rice-shrimp model appears workable however it should be monitored closely. At present some farmers practice two crops per year (3-4 months each); often use natural stock; and raised them under natural condition (no feeding); and the current production is about 200~250 kg/crop/ha/year. Most shrimp raised are P monodon (effort to raise white shrimp was not successful). Water exchange has to be made on a daily basis.

Current issues are water pollution from the ponds and in the canals. To address the issue it is necessary to improve the design of existing ponds (a normal pond depth is about 0.5-0.7 meter), improve water supply and drainage, and design proper treatment of bottom sediment but some investment will be necessary. Famers are now more open to suggestion to apply fertilizer and bio treatment (rather than chemicals) and other options such as using quality PL, etc.

Institution and regulations: There is a set of standards on wastewater discharge from intensive shrimp farming. Local Department of Agriculture and Rural Development (DARD) is responsible for ensuring compliance of the standards. All intensive shrimp farmers will have to be registered with local DARD. It is however difficult to register small farmers given the limited access to these farms, limited number of officials, and limited government budget. It is possible that the local government may have information on the locations and owners of these small

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12 Based on information provided by the Research Institute of Aquaculture 2 (RIA2) in Ho Chi Minh City and discussion with local expert.
farms since there is an extension center in every province, one extension group in every district, and one extension officer at each commune and village.

Research and Technology: There were various research activities conducted with assistance from donors in the past however it is not known how the results have been integrated into the farmer practices. Most farmers are very poor, low education, no money, so it will be difficult for them to change their practice as recommended by researchers. In the central Vietnam in mid 2000’s, there were efforts to establish farmer organization for shrimp farm using participatory approach as well as development of water supply models that could improve water quality and management of sediments, including a shrimp farm management manual; however it is not clear how these models/efforts have been applied on the ground.

Priority needs: To promote sustainable shrimp in Mekong Delta, a national specialist that the following four activities should be implemented in parallel: (a) to provide water supply with good quality (salinity not more than 4ppm), (b) to promote extensive farming with appropriate management of wastewater and sediment from each farm; and (c) to forge effective cooperation among farmers. Based on research activities in the area, the Research Institute of Aquaculture 2 in Ho Chi Minh City (RIA 2) suggested that provision of water supply to the farmers will be the first priority and the semi-extensive shrimp farming should be promoted through the following improvement:

- Improve pond/dyke design and management to control/ manage water pollution from farm;
- Conduct pilot study for the application of fertilizer and bio-treatment and promote close system;
- Improve quality of PL (post larvae);
- Establish farmer organization comprising farmers from 1-2 clubs and with extension officers and provide training on farm management to them;
- In some area capital investment will be necessary to separate water supply from drainage, if possible selected farms could be made to demonstrate how it is done; and
- Conduct workshops among researchers and farmers (in country and/or outside) to exchange knowledge and experience.

It is anticipated that for the subproject where aquaculture/shrimp farming is also an important land use, an effort will be made as part of the IPM program, to (a) develop an inventory, (b) review the current pollution situation, (c) monitor the water quality, and (d) promote adoption of good practices for aquaculture/shrimp farming. A TOR will be developed in closed consultation with the subproject owner and the provinces and key stakeholders. The priorities identified above will be considered.