Assessing the impact of Bioversity International's project "overcoming poverty in coconut growing communities"

Froukje Kruijssen
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Nijmegen, the Netherlands

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ABSTRACT

In this paper we assess the impact of the project "Overcoming poverty in coconut producing communities" implemented by Bioversity International in collaboration with national partners and funded by IFAD. The main questions addressed are whether the project has achieved its objectives, what Bioversity's role has been in the project, and how the costs of the project relate to the benefits achieved. Four main interventions were examined, the introduction of food security and income generating intercrops, introduction of livestock, production and marketing of high value coconut products, and the identification and characterization of high yielding and high value local coconut varieties and the establishment of nurseries to propagate and distribute seedlings of these varieties.

The study finds that although the impact of some of the separate interventions is inconclusive, the project has positively influenced total household income in 9 out 14 evaluated communities. At the global level the project has positively influenced expected total household income by 1778.06 international dollar. Food security has improved in 5 out of 14 communities and at the global level. In the 10 countries a total of 19 community-based organizations (CBOs) were established. A total of 7146 farmers participated in trainings on CBO management, intercrop production, livestock rearing, high value product production and marketing and nursery establishment and plant breeding. Of these participants 55 percent was female. By identifying, characterizing, and documenting local high yielding and high value coconut varieties, and improving access to high quality planting material through the establishment of community-managed nurseries, on-farm conservation of coconut genetic resources is improved. A total of 48 coconut varieties were identified, characterized and documented in ten countries and 36 nurseries were established which together distributed 12,265 seedlings. The impact on yield could not be measured as new seedlings are not bearing yet. The project benefit-cost ratio has been estimated at 2.35, based on present benefits and excluding non-market benefits such as documentation of genetic resources, skills development and food security improvement. Farmer costs could not be estimated because of a lack of data on farmer labour investments, but the critical boundary where the costs are exactly equal to the benefits lie at an additional labour investment of 16% of total available household labour.

Constraints in project implementation included external factors such as pests and diseases and natural calamities, issues in the enabling environment like lack of infrastructure and government support, and internal factors such as weak CBO- and micro-credit management and lack of marketing skills.

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LIST OF ACCRONYMS

ADB	- Asian Development Bank
CBO	- Community Based Organization
CFC	- Common Funds for Commodities
CGIAR	- Consultative Group on International Agricultural Research
COGENT	- International Coconut Genetic Resources Network
HVPs	- High Value Products
IFAD	- International Fund for Agricultural Development
IPGRI	- International Plant Genetic Resources Institute
NARS	- National Agricultural Research Systems

1 INTRODUCTION

The aim of this study is to assess the impact of the project "Overcoming poverty in coconut growing communities" funded by the International Fund for Agricultural Development (IFAD) and implemented by Bioversity International through the International Coconut Genetic Resources Network (COGENT) from 12 July 2005 until 11 July 2008. The study also aims to document the role that Bioversity International has played in the outcomes of the project.

Bioversity International (formerly the International Plant Genetic Resources Institute) is an independent international research institute that "undertakes, encourages and supports research and other activities on the use and conservation of agricultural biodiversity, especially genetic resources, to create more productive, resilient and sustainable harvests. [The] aim is to promote the greater well-being of people, particularly poor people in developing countries, by helping them to achieve food security, to improve their health and nutrition, to boost their incomes, and to conserve the natural resources on which they depend" (IPGRI, 2004). To achieve this, Bioversity carries out a range of activities and works intensively with partners at different levels and has established several international networks (IPGRI, 2004). One of these networks, the International Coconut Genetic Resources Network (COGENT) was founded in 1992. It is a global network of coconut producing countries, seeking to improve the production and use of coconut and the conservation of its diversity. COGENT aims to bring together crop scientists, social scientists, private sector stakeholders, enterprise and innovations specialists, and decision-makers to develop models of best practice, guidelines and other knowledge that contribute to the effective conservation and use of coconut genetic resources (COGENT website).

After its inception COGENT started mobilizing funds to implement collaborative activities among the member countries. The Asian Development Bank (ADB) provided US$800,000 for coconut conservation and evaluation in 13 Asia-Pacific countries under the ADB Phase 1 project (1994-1997) and US$1,200,000 for coconut collecting and conservation activities in 20 countries under the ADB Phase 2 project (1998-2000); the International Fund for Agricultural Development (IFAD – phase 1) provided US$907,000 for support to 14 countries and Bioversity to promote sustainable use of coconut genetic resources to enhance incomes and nutrition of smallholders in the Asia Pacific region (1998-2000); the Common Fund for Commodities (CFC) provided US$1,198,000 for the multi-location trials project in 3 African and 3 Latin American countries and technology transfer worldwide (1999-2004). The CGIAR through Bioversity has provided funding support to COGENT at the level of US$400,000 per year. Other organizations have also provided funding for occasional activities and the administrative management of the network. The project assessed in this document is the second phase of the IFAD-funded project and builds on the progress made under the other projects, especially on IFAD phase 1.

The goal of the project assessed in this study, is to help developing countries overcoming poverty among marginalized coconut farmers in China, Ghana, India, Indonesia, Jamaica, Malaysia, Mexico, the Philippines, Tanzania and Thailand through improved coconut-based farming systems and the diversification and effective use of coconut products and by-products. Research organisations in Vietnam have also linked up with the activities in this project through funding from other sources and this country will therefore also be included in this assessment. The major interventions of the project are to improve the production and marketing of high-value products

from all parts of the coconut, to establish community-managed coconut seedling nurseries and selling high-quality coconut seedlings, to introduce cash and food security intercrops, and livestock and/or fodder production.

To achieve the objectives of assessing impact and establishing Bioversity's role, the study addresses the following key questions:

- What activities were carried out by Bioversity International and partners to develop the capacity of community-based organizations (CBOs), National Agricultural Research Systems (NARS) and national extension systems to enable them to develop sustainable livelihood intervention models for coconut-growing communities; to promote farmer participatory activities in *in-situ* and on-farm conservation and to enhance coconut genetic resources; and to develop viable community-based income-generating technologies in support of sustainable livelihoods in the target countries?
- How have the intercropping, livestock and high value product strategies affected household income?
- How has the project affected household food security (level of food security and coping mechanisms)?
- What were the outputs of the nursery establishment intervention?
- What were the key factors that have influenced the impact of the project on livelihoods?
- What key outputs were produced by Bioversity's research?
- What role did Bioversity play in the implementation of the activities? To what extent could that role have been played by someone else?

The remainder of this paper is structured as follows. Section 2 describes a conceptual framework of the intended outputs of the project. Subsequently section 3 describes the methodology used in this study. Section 4 presents the results of the study and finally section 5 provides a discussion and some conclusions.

2 METHODS

2.1 Impact evaluation of development projects

Methodological issues

The economic surplus approach (which measures returns on investment by calculating the change in consumer and producer surpluses that result from technological change, and the net present value or internal rate of return) is the most popular methodology to assess the impact of agricultural research. In this study however, we are evaluating social sciences research and in this case methodological difficulties arise to apply this framework (Maredia et al., 2000). We will therefore apply alternative methods.

The evaluation of impact of a development project deals with assessing whether the project has achieved the intended changes on the short- or medium-term and attributing these changes to the intervention. A major consideration for impact evaluations is the counterfactual, which is the change that would have occurred without the intervention. Other confounding factors may have contributed to the magnitude and distribution of the outcomes and to establish the causal relationships between the intervention and the outcome it is thus necessary to establish the

counterfactual. Establishing the counterfactual implies that we account for both observed and unobserved intervening factors and for so-called contemporaneous events. These are events that occur during the implementation of the project and that influence the outcome. For example, the establishment of a tarmac road to a village where there was none at the start of the project (Ezemenari, 2000). Apart from this attribution of outcome to the project intervention we are also interested in attribution of the outcomes to the implementing agency.

By comparing participants of the project to non-participants we do not avoid this problem as here the problem of 'selection bias' may arise. This means that at the outset of the project there have been differences between the two groups that explain part of the outcome. This pitfall could be avoided with a random assignment experiment. This implies that individuals, villages, or some other grouping are randomly assigned to different intervention conditions (or to a no-treatment control group). This should guarantee that the intervention and control group start out with the same conditions (Cook, 2000). However, this type of experiment can also yield substitution bias, which means that results of the project under evaluation are understated because the control group has found substitutions for the program. Other social or ethical problems that may arise with this approach are that expectations are raised unfairly, that cooperation is poor if no potential benefit is offered, and that the costs of the study are raised both by 'unproductive' time spent on controls and any compensation given to those included in the control group (Stern et al., 2004). Alternative approaches that develop statistical means, such as selection models are promoted (Heckman, 2000).

Non-experimental designs come in many forms. They can roughly be divided into two groups, depending on the assumptions of 'conditional exogeneity of placement', which is the requirement that the placement of an individual in the treatment or non-treatment group is independent of unobservable differences in characteristics. The first group includes single- and double- or triple-difference methods. Single-difference methods compare outcomes between participants and non-participants, while the higher order difference methods assess both groups of participants and non-participants before and after an intervention. The second group of non-experimental designs relaxes the exogeneity assumption and uses instrumental variables in the analysis (Ravallion, 2008).

Due to the design of the survey during project implementation we are limited in the choice of analytical approach. There is no data on a non-participant group and we are therefore limited to the use of a 'reflexive comparison', or 'before-after estimator', which uses pre- and post-project data to impute the missing counterfactual outcomes for project participants (Todd, 2008). This approach is normally applied for full-coverage interventions which do not have a feasible control-group (Prennushi et al., 2002). To overcome the major drawback of the lack of a control-group that can qualify as a counterfactual we will use secondary data to construct statistical controls that can form the counterfactual (as suggested in World Bank (2006)).

Outcome indicators

To evaluate the outcome of a project the observable outcome indicator that is most relevant to the project should be clear. Projects are usually developed according to the intervention logic chain which explains the impact pathway of a project.

The project under evaluation included a large number of activities (Annex 1). The three major components are:

1. Community empowerment: the project aimed to establish CBOs and a microcredit system for each of them with a revolving fund. For each of the CBOs, an action plan for income-generating activities was to be developed and implemented. Training manuals on income-generating technologies and instruments for analysis and promotion of viable technologies were also planned to be developed to undertake the training of coconut farmers, women and village-level entrepreneurs on income generating technologies.
2. Income-generating interventions: these were based on a four-pronged strategy consisting of (1) improving the production and marketing of high-value products from all parts of the coconut; (2) establishing community-managed coconut seedling nurseries and selling high-quality coconut seedlings; (3) introducing cash and food security intercrops; and (4) introducing livestock and/or fodder production.
3. Knowledge dissemination and networking: this included the promotion of the use of research results through field days, the establishment of collaborative linkages with other development organizations in planning, implementation, monitoring, evaluation and impact assessment, and the publication of technical guides and bulletins, articles in local dailies, scientific papers, and catalogues of food recipes, high value products and coconut varieties.

Through these components the project intended to achieve the following objectives:

- Capacity–building for community-based organizations (CBOs), NARS and national extension systems to enable them to develop sustainable livelihood intervention models for coconut-growing communities.
- Promotion of farmer participatory activities in in-situ and on-farm conservation and enhancing coconut genetic resources.
- Development and implementation of viable community-based income-generating technologies in support of sustainable livelihoods which directly benefit resource-poor coconut farmers and socio-economically disadvantaged women by increasing income and food security.
- Collaboration with development organizations in mobilizing additional resources for scaling up and replicating sustainable livelihood interventions nationally and internationally, including funding of the envisaged micro-credit system.

A schematic overview of the activities, outputs and outcome, the so-called impact pathway of the project, is given in Figure 1.

In this study we describe the community empowerment and knowledge dissemination components; however most attention will be given to assessing the income-generating interventions, mainly because these can be more easily quantified. Table 1 presents an overview of these interventions, the nature of the outcomes aimed to be achieved by these interventions and the timeframe and indicators of each of these outcomes.

Table 1. Interventions, outcomes, timeframe and indicators

Intervention	Nature of outcomes	Timeframe	Indicators
Production and marketing of coconut high value products	Higher income derived from coconut	Short / medium-term	Income in categories compared to baseline
Establishment of nurseries and selling high-quality seedlings	More knowledge of coconut genetic resources management Higher availability of high-quality planting material	Immediate Immediate	Skills training received Number of seedlings planted
Introduction of cash and food security intercrops	Higher income derived from intercrops Improved food security Improved nutritional status	Immediate Short-term Long-term	Income in categories compared to baseline Coping strategies
Introduction of livestock and/or fodder production	Higher income derived from livestock Improved food security Improved nutritional status Higher availability of natural fertilizers	Immediate Short-term Long-term Immediate	Income in categories compared to baseline Coping strategies Production costs / productivity

Source: Framework as proposed by Ezemenari et al., 2000.

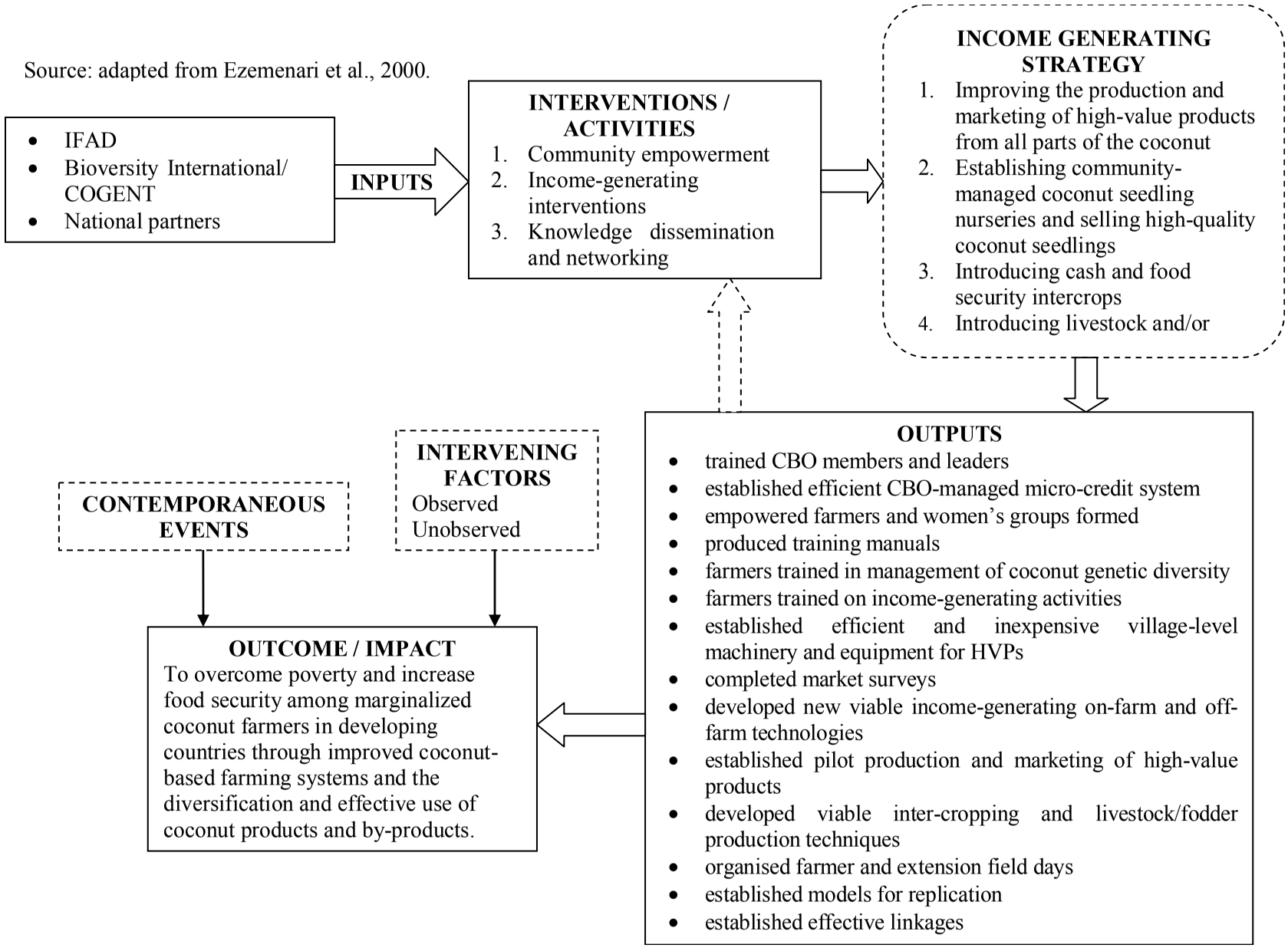

Figure 1. Impact pathway of the project

2.2 Data

Socio-economic data
As part of the project, collection of data was carried out independently in each country, using a standardized questionnaire template (see Annex 2). Depending on the country, socio-economic baseline data was collected late 2005 or early 2006 and a second set of data was collected late 2007 or early 2008. Some countries adapted the questionnaire to suit their situation. Baseline and post-project data are available from 9 countries (however one community missing in the Philippines for post-data). Two countries (Jamaica and Tanzania) have an incomplete dataset as they only collected one out of the two datasets (either baseline or post). During the course of the project, the implementing organisation in Jamaica faced problems with understaffing and decided with the international project coordinator to carry out limited project activities. In the remainder of this paper Jamaica is therefore no longer mentioned. Table 2 presents an overview of the sample size, by community in each of the countries. The countries that are included in this study are Ghana, India, Malaysia, Mexico, Philippines, Thailand and Vietnam.

Table 2. Sample size for baseline and post project socio-economic data

Country	Nr of communities	Sample size baseline per community	Sample size post-project per community	Remarks
China	1	20	20	excluded, sample too small
Ghana	1	106	41	
India	3	50-50-50	50-50-50	
Indonesia	2	20-30	20-30	excluded, too simplified questionnaire
Jamaica	1	43	N/A	excluded, limited project activities carried out
Malaysia	1	57	35	
Mexico	1	32	29	
Philippines	2	53-52	35-50	
Tanzania	2	N/A	23-32	excluded, conducted PRA for baseline instead of questionnaire
Thailand	3	54-53-43	52-56-57	
Vietnam	3	21-21-21	19-30-27	

The socio-economic data from all countries was assembled in one dataset, containing all common variables. The dataset contains variables on household composition and education, landholding, coconut production, income variables in different categories, expenditure in categories, skills development, living indicators, loans, organization and gender aspects. Most countries have used a revised version of the questionnaire, which means that some countries have less detailed data. Some variables therefore have missing data for some of the countries.

Socio-economic data collection was conducted separately in each of the project countries. Although before the start of the project a training workshop was conducted for the national

partners this could not ensure the uniformity of data collection. Annex 3 gives an overview of the sampling strategies and dates of data collection for each of the countries.

The sample size of Ghana is unbalanced, with 106 observations before the project and only 41 after the project, which may cause problems in the analysis of the complete dataset. We will correct this by re-sampling the baseline data, randomly selecting 41 out of 106 observations.

For a more intuitive understanding of the results and to enable some comparison between countries we have converted all financial data into international dollars, using the Purchasing Power Parity conversion factors of 2005[1]. To enable a comparison between the baseline and post-project data we also used the 2005 conversion factors for the post-project, corrected for the respective national inflation rates[2].

Food security and nutrition data
Data was also collected on the food security and nutrition situation of households before and after the project. Unfortunately, this survey was conducted with a different group of households from the socio-economic survey. We are therefore unable to link the data of the two surveys. The nutrition data were not analysed and are not available.

Attribution questionnaires
To assess the role of Bioversity International for the implementation and outputs of the project a questionnaire was designed and disseminated to the partners (see Annex 4). This questionnaire contains questions on the role of Bioversity International and partners in the outcome of the project. The survey was conducted with the national project coordinators or other national partner staff, and some of their partners.

Secondary data
The following sources of secondary data were used:

- National statistics. Because this study is using a "reflexive comparison" without a control-group of non-beneficiaries a counterfactual situation will be established by using national statistical data derived from secondary sources where available. This allows for an analysis of the national or regional general trends of income growth and changes in food security.
- Contemporaneous events. During the final workshop of the project the project partners evaluated external factors that positively or negatively affected the outcomes of the project. These qualitative data will be used to assess the influence of contemporaneous events. Secondary data were also used on world market prices of copra and other coconut products.
- Community level reports. For the analysis of the community-level interventions secondary sources will also be used including the country project reports on micro-credit, high value products and community nurseries.
- Financial reports. Financial reports that were prepared for the donor were used as a basis for the cost-benefit analysis.

[1] The Purchasing Power Parity (PPP) is the long-run equilibrium condition for the exchange rate of a country (Abuaf and Jorion, 1990), i.e. the adjustment of the exchange rate that allows for the comparison of the same goods among countries. The conversion factors for 2005 have been released by the International Comparison Program of World bank. See: http://siteresources.worldbank.org/ICPINT/Resources/ICP_final-results.pdf.
[2] National inflation rates for 2005-2007 were derived from the CIA World factbooks 2006, 2007 and 2008. See: https://www.cia.gov/library/publications/the-world-factbook.

3 DATA ANALYSIS

3.1 Model specification

For the analysis of the outcomes we start with the following equation:

$$I_i = a + bS_i + cX_i + \varepsilon_i, \quad (1)$$

where *I* represents the outcome indicator before and after the project, *S* represents the strategy implemented (the subscript i stands for the moment of measurement, i.e. 0 before the project, and 1 after the project) and *X* includes control variables that explain household income, such as education, age, household size, and other household characteristics as well as GDP, inflation and growth in the agricultural sector. □ denotes other determinants of income and measurement errors. The impact of the project is therefore given by *b* which measures the difference in predicted outcome with and without the project.

Because we do not have data available of a group of non-participants we can only compare two cross-sectional datasets of participants before and after the project (or treatment). We use a two-stage procedure to capture any observed and unobserved differences between the two groups that are not caused by the project.

In the first stage we estimate a probit function in which the dependent variable is a dichotomous variable that indicates measurement before ('0') or after (1) the project. This function estimates the parameters that have changed during the project which are not the outcome indicators and are therefore assumed to be outside of the control of the project. The Inverse Mills Ratio that can be derived from this estimation is then used in the estimation of the equations for the outcome indicators. This should ensure that we control for observed and unobserved differences between the two groups.

3.2 Variables

Outcome indicators

In this study we use the following outcome indicators:

- Income derived from intercrops: this is the annual household income derived from intercrops converted in international dollars by using Purchasing Power Parity (PPP).
- Income derived from livestock: this is the annual household income derived from livestock converted in international dollars by using PPP.
- Off-farm income: this is the annual household income derived from processed agricultural products converted in international dollars by using PPP.
- Total income: this is total annual household income derived from all sources converted in international dollars by using Purchasing Power Parity (PPP)

A comparison of the descriptive statistics of the baseline and post-project data by country is presented in Table 3. A full overview of a comparison of descriptive statistics by community is given in the specific sections.

Table 3. Comparison of descriptive statistics of indicators by baseline and post-project

	Baseline					Post-project					
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	Sign.
Income from livestock											
Ghana	41	85.35	224.03	0.00	1292.80	41	303.92	534.38	0.00	3339.04	**
India	150	141.96	462.59	0.00	3169.73	150	622.06	1221.94	0.00	5626.60	***
Malaysia	57	48.96	123.12	0.00	751.45	35	204.51	415.42	0.00	1584.77	**
Mexico	32	385.87	676.26	0.00	2103.79	29	332.57	730.19	0.00	2603.44	
Philippines	87	564.45	849.98	0.00	4275.86	85	568.73	937.13	0.00	4813.27	
Thailand	140	717.35	1611.44	0.00	10043.94	163	437.89	1309.02	0.00	11168.95	*
Vietnam	63	249.59	308.21	0.00	1273.16	76	386.61	800.24	0.00	5467.82	
Total	570	368.39	961.68	0.00	10043.94	579	469.21	1071.19	0.00	11168.95	
Income from intercrop											
Ghana	41	78.73	226.25	0.00	1249.80	41	128.69	155.75	0.00	663.39	
India	150	60.52	126.35	0.00	1154.74	150	254.88	429.43	0.00	2724.62	***
Malaysia	57	132.82	282.79	0.00	1202.31	35	27.79	96.98	0.00	491.83	**
Mexico	32	61.01	92.90	0.00	294.53	29	58.49	81.80	0.00	291.59	
Philippines	87	64.98	135.45	0.00	694.25	85	916.86	1099.81	0.00	4806.54	***
Thailand	138	45.22	201.99	0.00	1506.59	163	55.05	223.28	0.00	528.5	
Vietnam	63	94.30	184.43	0.00	954.87	76	113.75	274.83	0.00	1093.56	
Total	568	68.83	182.17	0.00	1506.59	579	244.78	577.98	0.00	4806.54	***
Off-farm income											
Ghana	41	1.31	8.39	0.00	53.75	41	0.00	0.00	0.00	0.00	
India	150	5.45	66.79	0.00	818.00	150	163.06	427.38	0.00	3619.55	***
Malaysia	57	37.72	184.49	0.00	1248.55	35	351.46	962.62	0.00	5027.55	*
Mexico	32	0.00	0.00	0.00	0.00	29	0.00	0.00	0.00	0.00	
Philippines	87	135.01	320.71	0.00	1931.03	85	144.10	411.72	0.00	2524.44	
Thailand	138	1140.86	1909.13	0.00	9730.07	163	1558.95	2488.69	0.00	14621.81	
Vietnam	63	173.19	280.11	0.00	1060.96	76	916.92	1292.03	0.00	6561.39	***
Total	568	322.39	1062.23	0.00	9730.07	579	643.87	1573.79	0.00	14621.81	***
Total income											
Ghana	41	1316.93	1056.65	53.75	3870.34	41	1276.18	1110.76	168.06	6368.50	
India	150	1749.93	847.44	177.37	5248.33	150	3952.55	2071.70	45.61	13687.28	***
Malaysia	57	3907.85	2919.68	289.02	14797.69	35	5267.70	4663.74	792.39	21115.70	
Mexico	32	3462.42	2010.12	1297.34	9438.99	29	3826.65	1619.67	1390.24	9613.20	
Philippines	87	2325.56	2235.58	0.64	11767.82	84	3887.26	3618.33	0.00	17233.53	***
Thailand	138	5561.01	4854.08	0.00	28970.50	163	9893.87	9339.01	293.61	69204.01	***
Vietnam	63	1773.34	824.69	636.58	4167.46	76	3705.60	1759.32	229.65	9368.21	***
Total	568	3048.40	3224.90	0.00	28970.50	578	5469.56	6137.24	0.00	69204.01	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Explanatory variables

We differentiate between three types of explanatory variable: general, household characteristics, contemporaneous events, national developments and international coconut prices. The contemporaneous events were assessed in an exercise during a workshop with national project coordinators Four main categories were distinguished, i.e. government support, infrastructure, pests & diseases, and natural calamity. These contemporaneous events have been included in the dataset as a set of dummy variables. A complete list of events and countries where they occurred can be found in Annex 5.

The national statistics have been included in the socio-economic dataset. Because incomes have been converted in international dollars by using Purchasing Power Parity and corrected for inflation we have made them more comparable and have taken into account changes in purchasing power in the individual countries.

Another important factor to consider is the market prices of copra and other parts of the coconut. The main coconut products traded in the international market are copra (the dried meat or kernel

of the coconut) and coconut oil (extracted from the copra). While world production has remained more or less stable over the years 2005-2007, that of individual countries has not (see Annex 6). Especially Indonesia has seen a substantial drop in coconut production in 2006, while India has had a temporary increase in the same year. Prices have however experienced a sharp increase in 2007 and the first half of 2008, with prices at its highest in June of 2008. This is mostly assigned to the rise in price of biofuels. After June 2008 (and the end of the project), prices have started to drop sharply, with present (Oct 2008) prices at a similar level as 2005/2006 (Philippine Coconut Authority, 2008).

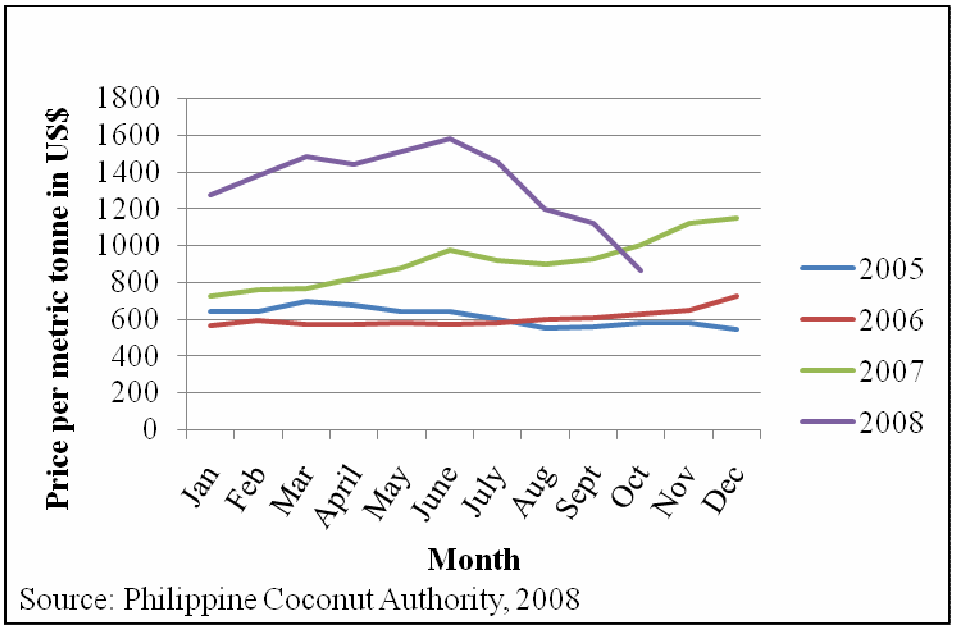

Figure 2. European market prices of coconut oil 2005-2008 (US$)

The domestic price of copra is linked to the world price of coconut oil (as it is the base product for oil) and showed a similar pattern.

A summary of variable definitions and descriptive statistics is given in Table 4. Descriptive statistics by country / community are given in Annex 7.

Table 4. Definition of explanatory variables and descriptive statistics

Variable	Definition	Value	N	Mean	SD	Min	Max
General							
Site	Location (differences in agro-ecology, climate, ethnicity, market access etc.)	1=Nvuma (Ghana), 2=Pathiyoor (India), 3=Devikulangaragara (India), 4=Thodiyoor (India), 5=Matunggong (Malaysia), 6=Bixina Tabasquena (Mexico), 7=San Miguel (Philippines), 8=Tunkalan (Philippines), 9=Khog Wauw (Thailand), 10=Thung Ka (Thailand), 11=Saeng Arun (Thailand), 12=Binh Khanh Tay (Vietnam), 13=Chau Binh (Vietnam), 14=Duc My (Vietnam)	1166	6.96	3.787	1	14
Data	Measurement moment	0=baseline, 1=post-project	1166	0.50	.500	0	1
Household characteristics							
Household size	Available human capital	Number of members in the household	1160	4.75	2.156	1	20
Age head	Experience, human capital	Age in years of the head of household	1120	45.58	12.660	17	89
No religion	Socio-cultural	0=No, 1=yes	1093	.07	.251	0	1
Buddhist	Socio-cultural	0=No, 1=yes	1093	.39	.489	0	1
Christian	Socio-cultural	0=No, 1=yes	1093	.28	.448	0	1
Hindu	Socio-cultural	0=No, 1=yes	1093	.17	.376	0	1
Muslim	Socio-cultural	0=No, 1=yes	1093	.09	.285	0	1
Education head	Socio-cultural	0=No education, 1=Primary, 2=Some high-school, 3=High-school, 4=Some college, 5=College or vocational training, 6=Post-graduate	1154	2.02	1.323	0	6
Gender head	Socio-cultural	0=male, 1=female	1160	.56	.496	0	1
Status head	Marital status, socio-cultural	0=single, divorced, widow(er) 1=married	1153	.91	.282	0	1
Farm size	Available resources	Total farm size in hectares	1153	2.24	3.599	0	46.4
Income diversification	Diversity of economic activities	Between 0 and 1, where 1 is completely specialized	1143	.59	.212	.00	1.00
Contemporaneous events							
Government support	Availability of government support	-1=negative, 0=neutral, 1=yes	1166	.53	.649	-1	1
Interest rate	Interest rates on micro-credit loans	-1=high, 0=neutral, 1=low	1166	.44	.622	-1	1
Electricity	Availability of electricity	-1=not available, 0=available	1166	-.35	.476	-1	0
Roads	Availability of roads	-1=negative, 0=neutral	1166	-.27	.443	-1	0
Buildings	Availability of buildings of activities and storage	-1=negative, 0=neutral, 1=yes	1166	-.01	.710	-1	1
Plant disease	Occurrence of plant disease	-1=yes, 0=no	1166	-.28	.448	-1	0
Livestock disease	Occurrence of livestock disease	-1=yes, 0=no	1166	-.12	.324	-1	0
Plant pests	Occurrence of plant pests	-1=yes, 0=no	1166	-.79	.448	-1	0
Natural calamity	Occurrence of natural calamities	-1=yes, 0=no	1166	-.12	.324	-1	0

4 RESULTS

4.1 Income derived from intercrops

The intercropping intervention aimed to increase income derived from crops planted between coconut trees and to improve the food security and nutritional situation of the households involved. Each country selected the most suitable intercrops, both cash and food crops, for the agronomic and market conditions in the project sites. The project assisted in the selection of crops and provision of planting material and inputs through a micro-credit scheme. Table 5 presents an overview of the number of participants in each country, together 1000, and the crops introduced for all ten countries. Crops like tubers were intended to enhance the food security of the CBO-members, whereas crops like vegetables and fruits aimed to improve their nutritional status. Other crops such as cacao and watermelon were mainly introduced to enhance income. Apart from deriving extra income, intercropping had the potential to improve the performance of coconut because of additional management provided for the intercrops and the creation of a better microclimate in the coconut-based farming systems. CBO members were also trained in the production of intercrops and in vermi-composting. A total of 40 technical trainings on intercropping were conducted (Annex 8).

The remainder of this section will evaluate the income derived from intercrops in the selected seven countries only. Because the livestock intervention may also have an effect on the food security situation in the communities, this aspect will be assessed separately in section 4.6.

Table 5. Overview of intercrop intervention

Country	Nr of participants	Crops introduced	Comments
China	29	Banana, Papaya, Arecanut, Peanuts, Cassava, Sweet Potato, Vegetables	-
Ghana	23	Eggplant, Cassava, Plantain, Pepper	Poor soils, small areas planted
India	97	Tuber, Banana, Mushroom, Vegetables	Some damage due to water stagnation in 2007
Indonesia	72	Banana, Cacao, Pandanus	-
Malaysia	77	Tapioca, Maize, Pineapple, Banana, Tuber, Fruit trees, Vegetables	Problems with pests and diseases and seed germination
Mexico	16	Watermelon, Chillies, Papaya, Banana, Cassava	Winds and rain destroyed crops in 2007
Philippines	138	Corn Vegetables Banana, Watermelon, Fruit trees	Drought and strong winds affected production. Typhoon in 2006 destroyed most crops in 1 community
Tanzania	39	Legumes Cassava Sweet Potato Maize, Groundnut Pineapple	Lack of rain limited production
Thailand	125	Sweet Potato, Vegetables, Banana Papaya Lemon grass, Arecanut, Taro	-
Vietnam	384	Banana, Cacao, Mango, Orange, Papaya, Pomelo, Sugarcane, Sweet Potato	Problems with salt water intrusion.
Total	**1000**	-	

Source: Country project reports

Table 3 has shown already that in three out of seven countries (India, Malaysia and Philippines) a significant difference in mean income derived from intercrops before and after the project can be observed. In Vietnam the project was implemented in three communities of which one has seen a significant decrease and one a significant increase in mean income derived from intercrops. The mean difference of the total sample is also significant and positive.

We start by estimating the first-stage regressions to derive the Inverse Mills Ratio. The results of this regression for the entire sample is presented in Table 6, the results for the individual countries are presented in Annex 9.

Table 6. Probit with dependent variable 'project'

Explanatory variable	Coefficient	Standard Error	Sign.
Community	.062	.022	***
No religion	2.731	.606	***
Gender head	.249	.134	*
Buildings	-.219	.094	**
Herfindahl index	-2.602	.331	***
Constant	1.064	.245	***
N		1070	
Chi-square		152.864	***
Nagelkerke R square		.178	

Note: The dependent variable indicates measurement before ('0') or after (1) the project. *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

With the Inverse Mills Ratio as a control variable, we estimate the second stage regression with OLS. The results are presented in Table 7. We only show the results for those countries that showed a significant difference in mean income derived from intercrops before and after the project. The values in the table show all variables included in the regressions, these may differ between countries.

The results show that at the global level the project intervention has a significantly positive relationship with income derived from intercrops. Taking into account underlying observable and unobservable factors that have changed during the project, it positively influences expected income from intercrops by 191.75 international dollars. Differences between communities also affect the income derived from intercrop. A higher level of education positively influences expected intercrop income by 19.61 international dollar, not having a religion by 217.54 dollar. We further find infrastructure (roads) to have a significant relationship with income derived from intercrops. The coefficient is negative which seems counterintuitive because a lack of paved roads would have a negative value. It seems likely that those communities that are most remote have benefitted relatively more from the intervention as previously they had higher transaction costs to market their products while now they can benefit from the collective action created by the project intervention. Because these variables take a negative value if these situations have occurred, we find that the presence of plant and livestock diseases negatively influences expected intercrop income by 106.02 and 602.07 international dollars respectively. The Inverse Mills Ratio is also significant indicating a bias in the sample.

Table 7. OLS with IMR and dependent variable income from intercrops by country

Explanatory variable	All			India		
	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig
Project	191.75	27.063	***	105.53	34.60	***
Community	-19.76	4.506	***	-46.98	20.24	**
Household size				14.22	10.38	
Education	19.61	9.690	**			
No religion	217.54	100.472	**			
Gender head				-55.54	32.84	*
Farm size				695.94	115.99	***
Roads	-481.52	43.257	***			
Plant disease	106.02	41.194	**			
Natural calamity	602.07	104.439	***			
Inverse Mills Ratio	-153.06	60.651	**	-359.40	52.96	***
Constant	210.72	72.702	***	490.67	106.76	***
Adjusted R-square			.178			.296
Durbin Watson			1.633			1.827

Explanatory variable	Malaysia			Philippines		
	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig
Project	-129.84	49.046	**	840.81	133.830	***
Community						
Religion Christian				-834.36	462.633	*
Education head	8.43	25.287				
Farm size				92.81	41.231	**
Herfindahl index	-186.71	122.747		480.70	527.027	
Inverse Mills Ratio	-284.58	125.318	**	-348.45	618.733	
Constant	544.38	137.707	***	748.31	632.117	
Adjusted R-square			.103			.269
Durbin Watson			1.343			2.069

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level,void cells indicate that the coefficient is not significant.

From the regressions for the individual countries we find that in all three countries, India, Malaysia and Philippines the project intervention has a significant relationship with income derived from intercrops. While the coefficients of India and Philippines are positive, indicating a positive effect, we find a negative coefficient for Malaysia. This is not surprising as we found that the mean of intercrop income of the baseline was significantly higher than that for and post-project data. Participation in the project positively influences expected intercrop income by 105.53 international dollar in India and 840.81 international dollar in the Philippines, in Malaysia however the project has negatively influenced expected income from intercrop by 129.84 international dollars. In later sections we will analyse the other income sources to assess whether this reduction is a deterioration of the wellbeing of the households or is off-set by increases in other income categories.

The results of the regression for India show that the socio-economic variable gender of the household head and farm size have a significant relationship with intercrop income. Those households that have a male head and have more farm area are more likely to have a higher income from intercrops. For the Philippines the relationship with farm size is also positive. Being

of the Christian faith has a negative influence on income derived from intercrops. In both India and Malaysia we find a significant coefficient for the Inverse Mills ratio which indicates some bias.

In the regression for India we find the community variable to be significant. Table 8 presents a comparison of mean income derived from intercrops by community before and after the project.

Table 8. Comparison of means of intercrop income by community

	Baseline			Post-project			
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sign**
India	150	60.52	126.35	150	254.88	429.43	***
Pathiyoor	50	97.81	203.82	50	353.75	562.50	***
Devikulangara	50	50.98	54.57	50	189.57	244.54	***
Thodiyoor	50	32.79	41.59	50	221.33	411.20	***
Philippines	87	64.98	135.45	85	916.86	1099.81	***
San Miguel	35	31.40	121.13	35	1092.12	1074.34	***
Tunkalan	52	87.58	140.92	50	794.17	1111.48	***
Thailand	105	59.44	229.98	107	40.89	111.39	
Khog wauw	54	15.46	57.34	52	84.14	148.58	***
Vietnam	63	94.31	184.43	76	113.75	274.83	
Binh Khanh Tay	21	15.16	69.46	19	97.65	261.76	
Chau Binh	21	204.11	255.12	30	9.23	26.25	***
Duc My	21	63.66	123.73	27	241.20	374.18	**

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

We estimate separate equations for the communities that have a significant difference in mean intercrop income between baseline and post-project data (Table 9). The first stage regressions can be found in Annex 10.

Table 9. OLS with IMR and dependent variable income from intercrops by community

Explanatory variables	Pathiyoor - India			Devikulangara - India			Thodiyoor - India			San Miguel - Philippines		
	Coefficient	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**
Project	151.61	76.02	**	145.29	31.88	***	119.79	81.95		1279.46	250.81	***
Household size							24.16	17.77				
Education	-49.72	37.09		7.77	12.65		35.75	36.27				
Gender	-109.70	66.08										
Status head	26.71	142.20		41.47	55.59					-143.48	230.29	
Farm size				60.63	100.39					319.71	352.32	
Herfindahl index	-2797.97	363.55	***							903.67	874.77	
Inverse Mills Ratio	763.76	147.96	***	2675.67	522.36	***	-81.46	61.35		12.71	649.08	
Constant	1420.69	239.06	***	-2198.68	446.83	***	-61.32	158.65		-973.25	909.33	
Adjusted R-square			.486			.294			.108			.490
Durban Watson			1.912			1.747			2.042			1.022
Explanatory variables	**Tunkalan - Philippines**			**Khog Wauw - Thailand**			**Chau Binh - Vietnam**			**Duc My - Vietnam**		
	Coefficient	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**	**Coefficient**	**S.E.**	**Sig**
Project	629.41	152.95	***	60.17	26.04	**	-178.18	50.76	***	190.57	93.68	**
Household size	16.09	39.60								28.72	30.08	
Education							38.20	29.35		-145.958	84.67	*
Gender				-26.30	25.95							
Status head				-39.00	46.62					545.47	266.57	**
Farm size	81.90	41.56	**							337.16	235.22	
Herfindahl index							-195.09	154.31		-685.60	329.25	**
Inverse Mills Ratio	-613.21	392.01		-53.02	41.09		38.83	94.69		-439.18	261.63	
Constant	444.80	517.63		121.72	55.00	**	216.35	155.95		-467.86	505.20	
Adjusted R-square			.238			.096			.270			.150
Durban Watson			2.236			1.513			2.491			1.823

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

In six out of eight communities the project has positively influenced expected intercrop income. This is the case in Pathiyoor and Devikulangara of India (151.61 and 145.29 international dollar respectively), San Miguel and Tungkalan of the Philippines (by 1279.46 and 629.41 international dollar respectively), Khog Wauw in Thailand and Duc My in Vietnam (60.17 and 190.57 dollar). The project has negatively influenced expected intercrop income in Chau Binh in Vietnam (178.18 dollar). The Inverse Mills Ratio is significant in three cases, which indicates that in these cases there is a bias in the sample.

4.2 Income derived from livestock

As for the intercrop intervention, the main goal of the livestock strategy was the enhancement of the incomes and food security of resource poor coconut farmers. To achieve this, the project aimed to use the established and strengthened community-based organizations as the basis for management and dissemination of micro-credit for the purchase of livestock and dissemination of training. These activities should improve income by improving farmer access to investment capital (through micro-credit), the creation of jobs, improved skills of farmers, increased marketing of animals and their products, and through more effective use of coconut by-products. An overview of the types of livestock introduced and the number of participants in each of the communities can be found in Annex 11.

The intervention increased the knowledge base and technical skills (in animal husbandry practices, feeding, records keeping and marketing of their produce) of beneficiary farmers. A total number of 961 farmers were trained in livestock and feed production techniques of which 47 percent was female. Table 10 shows an overview.

Table 10. Participation in training courses on livestock and feed production by country

Country	Male		Female		Total
	Nr	%	Nr	%	Nr
China	59	57%	45	43%	104
Ghana	16	64%	9	36%	25
India	87	41%	124	59%	211
Indonesia	45	100%	0	0%	45
Malaysia	18	55%	15	45%	33
Mexico	0	0%	19	100%	19
Philippines	50	48%	54	52%	104
Tanzania	42	58%	30	42%	72
Thailand	15	42%	21	58%	36
Vietnam	177	57%	135	43%	312
Total	**509**	**53%**	**452**	**47%**	**961**

Source: Annual project reports

Table 11 shows a comparison of the means of income derived from livestock before and after the project, by country and community. The data shows that four out of seven countries (Ghana, India, Malaysia and Thailand) have a significant difference in mean livestock income. Although the difference in mean livestock income is not significant for the Philippines as a whole, we do observe a significant difference for one of its communities (San Miguel). The data at global level also show a significant difference in income derived from livestock.

Table 11. Comparison of means of livestock income between baseline and post-project

	Baseline			Post-project			
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sig.**
Ghana	**41**	**85.35**	**224.03**	**41**	**303.92**	**534.38**	**
India	**150**	**141.96**	**462.59**	**150**	**622.06**	**1221.94**	***
Pathiyoor	50	101.30	341.93	50	782.99	1470.46	***
Devikulangara	50	161.01	544.26	50	328.39	1001.71	
Thodiyoor	50	163.57	484.79	50	754.81	1114.56	***
Malaysia	**57**	**48.96**	**123.12**	**35**	**204.51**	**415.42**	**
Mexico	**32**	**385.87**	**676.26**	**29**	**332.57**	**730.19**	
Philippines	**87**	**564.45**	**849.98**	**85**	**568.73**	**937.13**	
San Miguel	35	395.47	618.87	35	43.58	78.06	***
Tungkalan	52	678.18	964.44	50	936.34	1080.00	
Thailand	**127**	**790.78**	**1675.15**	**107**	**267.67**	**1161.23**	*
Khog Wauw	50	503.45	1498.64	52	306.87	1550.18	
Thungka	53	567.74	933.70	56	763.13	1511.37	
Saeng Arun	37	1220.71	2313.69	55	230.62	611.99	**
Vietnam	**63**	**249.59**	**308.21**	**76**	**386.61**	**800.24**	
Binh Khanh	21	231.39	308.73	19	426.87	522.67	
Chau Binh	21	323.38	383.20	30	461.73	1122.24	
Duc My	21	194.01	207.40	27	274.81	482.41	
Total	**570**	**359.99**	**952.22**	**579**	**469.21**	**1071.19**	*

Notes: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

We again use the Inverse Mills Ratio derived from the probit function estimated in the previous section. With the Inverse Mills Ratio as a control variable, we estimate the second stage regression with OLS. The results are presented in Table 12. We only show the results for those countries that showed a significant difference in mean income derived from livestock before and after the project.

For only one out of four countries we find the project to have a positive influence on expected income derived from livestock. This is Malaysia, where the project positively influences expected livestock income by 155.67 international dollars. The coefficient for the project in Thailand is also significant, however the coefficient has a negative value, showing a negative influence. For the other countries and at the global level we do not find a significant influence of the project. Other observed and unobserved factors have contributed to the significant difference in mean income found in Table 11. The estimations for individual communities Thodiyoor and Pathiyoor give the same inconclusive result (see Annex 12).

In almost all estimations we do find a significant influence of income diversification on expected livestock income. This is shown by the Herfindahl index which indicates the diversity in income generating activities. A lower value of this index indicates a higher level of diversity in activities. The negative sign of the coefficient thus indicates that diversifying by one percent positively influences expected livestock income by 10.84 international dollar at the global level, and by 185.43, 2.99, and 10.81 international dollars for India, Malaysia and Thailand respectively.

Table 12. OLS with IMR and dependent variable income from livestock

Explanatory variable	All			Ghana			India		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	-51.39	66.47		177.59	124.05		141.82	97.55	
Community	28.35	11.17	**						
Household size							-207.51	50.775	***
Education head	72.00	23.66	***	69.34	33.96	**			
Farm size	14.87	8.88	*	81.24	45.04	*	-2664.13	669.21	***
Natural calamity	507.18	190.82	***						
Herfindahl index	-1084.31	298.56	***				-18543.20	2920.35	***
Inverse Mills Ratio	-360.90	265.55		-86.20	71.69		8461.45	1535.03	***
Constant	1044.98	163.76	***	-32.12	159.24		6337.71	875.23	***
Adjusted R-square			.097			.106			.329
Durbin Watson			1.803			2.133			2.216

Explanatory variable	Malaysia			Thailand		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	164,69	58,64	***	-555.78	175.81	***
Household size	-257,31	257,51				
Education head	284,27	272,34				
Gender head	1495,50	1643,12				
Farm size	-99,59	116,66		46.33	19.23	**
Herfindahl index	-299,46	152,51	*	-1081.06	528.18	**
Inverse Mills Ratio	-5080,58	5433,87		-605.14	480.49	
Constant	6710,62	6883,93		1869.76	333.77	***
Adjusted R-square			.112			.080
Durbin Watson			2.244			1.783

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

4.3 High value coconut products

The production of high value products from coconut was a project intervention aiming to increase income derived from the coconut through adding value to parts of the entire coconut palm by processing them into high value products such as virgin coconut oil, handicrafts and other food- and non-food products. This should also promote awareness of the importance of coconut. Many parts of the coconut tree and its fruit can be utilized raw, or converted into a high value product. The activities included the development of high quality marketable products from the coconut husk, midrib, shell and white meat (copra), to provide training of CBO-members in enterprise management and market linkages, and establishment and utilization of the appropriate equipment for the production of these high value products at village level.

The communities were supported with processing machinery, tools and micro-credit. They were trained on production, processing, utilization and marketing of products, that differ from country to country and from community to community. Rapid market surveys and profitability analyses were conducted for each type of product produced, to assess its potential in the market.

A total of 615 people were trained on production of non-food products, of which 57 percent was female and a total of 425 were trained on food products, of which 63 percent was female (see Annex 14)

Products that are produced and marketed include:

- Coir-based products such as rope, geotextile and doormats
- Shell-based products such as handicrafts (bowls, bags etc.)
- Oil-based products such as virgin coconut oil (VCO) both for food and cosmetic uses
- Copra-based products such as candy, pastries, sugar and vinegar
- Midrib-based products (of the leafs) such as baskets

Analysis of the impact of this intervention has three constraints. Firstly, the intervention is not applied uniformly across all countries. In some location it is an activity carried out the CBO level and incomes first befall to the CBO, while in other communities individual households carry out the activity. Secondly the data is not collected uniformly in all countries. In some cases income derived from high value coconut is included in coconut income, while in others it is part of off-farm income. The last constraint is also related to the data, because it is not possible to differentiate between income derived from coconut high value products and income from other off-farm activities.

To overcome some of these constraints we include in the analysis only those countries that have added high value products to off-farm income (India, Philippines, Thailand and Vietnam). Table 13 gives an overview of the income derived from off-farm activities before and after the project by community. The four countries together show a significant difference in mean off-farm income between baseline and after the project. Two of the four countries (India and Vietnam) show this significant difference at country-level, and six out of eleven communities show a difference at community-level (of which one difference is negative).

Table 13. Comparison of means of off-farm income by baseline and post-project

	Baseline			**Post-project**			
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sign.**
India	**150**	**5.45**	**66.79**	**150**	**163.06**	**427.38**	***
Pathiyoor	50	0.00	0.00	50	92.90	326.11	**
Devikulangara	50	16.36	115.68	50	125.96	530.94	
Thodiyoor	50	0.00	0.00	50	270.32	386.02	***
Philippines	**87**	**135.01**	**320.71**	**85**	**144.10**	**411.72**	
San Miguel	35	160.03	301.97	35	0.00	0.00	***
Tungkalan	52	118.18	334.56	50	244.97	515.15	
Thailand	**138**	**1140.86**	**1909.13**	**163**	**1558.95**	**2488.69**	
Khog Wauw	50	2684.24	2232.48	52	2546.32	2782.08	
Thungka	53	142.13	471.08	56	249.21	772.56	
Saeng Arun	35	448.39	1269.92	55	1958.97	2789.64	***
Vietnam	**63**	**173.19**	**280.11**	**76**	**916.92**	**1292.03**	***
Binh Khanh	21	325.36	366.69	19	2047.46	1531.36	***
Chau Binh	21	0.00	0.00	30	72.90	399.31	
Duc My	21	194.21	229.12	27	1059.14	1112.24	***
Total	**568**	**322.39**	**1062.23**	**579**	**643.87**	**1573.79**	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Table 14 shows the second stage regressions, with dependent variable off-farm income, for India, Philippines, Thailand and Vietnam with the inverse Mills ratio derived from a new first stage

regression (including only those four countries) with dependent variable 'project'. The results show that for the four countries together, the project does not have a significant influence of income derived from off-farm activities. Other factors, such as government assistance in the project, the occurrence of plant disease, the size of the household and the gender of the household head, do have a significant influence on off-farm income. Positive government intervention positively influences off-farm income by 596.13 international dollar, the occurrence of plant disease (for which the variable takes a negative value if present) negatively influences off-farm income by 700.74 international dollars. It is likely that with plant disease, production is lower and there is thus less access supply for processing. Having a female head of household negatively influence off-farm income by 196.07 international dollars and one additional household member negatively influences it by 69.75 international dollars. The Inverse Mills Ratio is also significant.

The second stage regressions for the individual countries show that for two out of four countries, India and Vietnam, the project positively influences off-farm income, by 71.09 and 655.70 international dollars respectively. For India an increase in farm size by one hectare negatively influences off-farm income by 1171.46 international dollars. Average farm size in the sample from India is 0.11 hectares and it seems likely that a land constraint is pushing farm households into off-farm activities, at community level we find that the contribution of farm size is positive in Pathiyoor and negative in Thodiyoor. The Inverse Mills Ratio is also significant for the Indian estimation.

At the community level we find that the project positively influences off-farm income in all four communities, Pathiyoor and Thodiyoor in India and Binh Khanh and Duc My in Vietnam, by 94.45, 136.02, 1671.49, and 613.07 international dollars respectively. In India another contributing factor to off-farm income is the level of education of the head of household.

The HVP intervention was not successful in all countries. This had different causes related to the marketability of the products such as limited access to markets and market information, poor quality of products produced, limited volumes for larger scale marketing, and competition of substitute products. The success of the production and marketing of the high value coconut products was also constrained by a lack of managerial skills at CBO-level and for the micro-credit system. There were also technical limitations such as the unavailability of efficient and cheap processing equipment and malfunctioning of equipment without access to spare parts. External factors that constrained this intervention were the occurrence of natural calamities (typhoons, floods, pests and diseases) which we already found in the results of the impact analysis.

Table 14. OLS with IMR and dependent variable off-farm income

Explanatory variable	All			India			Philippines			Thailand			Vietnam		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	99.37	111.41		71.09	33.30	**	-2.43	64.51		388.44	270.46		655.70	172.93	***
Community				49.04	19.78	**	114.00	74.10		-729.92	173.37	***	-237.76	108.86	**
Household size	-69.75	30.99	**	-100.34	17.47	***							53.45	67.36	
Education head				27.54	14.80	*									
Gender head	-196.07	109.95	*				-83.94	67.25							
Farm size				-1171.46	228.59	***	41.39	20.13	**	50.80	30.08				
Government	596.13	78.21	***												
Plant disease	700.74	144.76	***									*			
Herfindahl index				-7198.33	999.42	***				-1601.06	820.57	*	587.81	443.60	
Inverse Mills Ratio	-792.84	198.87	***	3483.34	525.71	***	-429.25	192.45	**	741.48	765.95		-223.74	292.95	
Constant	1389.84	255.06	***	2105.67	310.58	***	-420.03	632.41		8745.74	1857.58	***	2937.42	1605.92	*
Adjusted R-square			.111			.285			.069			.			.156
Durbin Watson			1.129			1.928			1.905						1.320

Explanatory variable	Pathiyoor - India			Thodiyoor - India			Binh Khanh - Vietnam			Duc My - Vietnam		
	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig
Project	94.45	47.66	*	136.02	70.29	*	1671.49	359.17	***	613.07	250.43	**
Household size	-14.58	12.00					199.56	179.83				
Education head	25.90	22.24		44.89	31.11		748.48	664.59		-256.37	162.08	
Status										-1217.33	614.08	*
Farm size	682.79	128.52	***	-1219.71	457.92	***						
Herfindahl index							2886.84	1015.98	***			
Inverse Mills Ratio	3.33	47.43		-139.11	52.56	**	2167.27	1920.46		-972.43	468.98	**
Constant	-95.31	99.31		183.83	117.29		-5183.07	3496.78		2542.44	674.26	***
Adjusted R-square			.276			.283			.465			.343
Durbin Watson			1.321			2.202			1.597			2.215

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

A case study was carried out of rope produced out of fibre of the coconut husk, in the village of Tam Quan Nam, in Binh Dinh Province Vietnam, as part of the project interventions:

"With the project's assistance, CBO-members identified the opportunity to increase efficiency of coconut husk processing by mechanising the labour-intensive practice of removing the husk and beating it into fibre. The project provided a collective loan, in the form of a set of beating and decorticating machines, to produce fibre from the coconut husks. In addition, 150 rope twining machines were lent to individual members.
The members volunteer to sell their raw product, coconut husks, to the organization at a slightly lower price than elsewhere. In return they benefit from a stable and higher income through making ropes and doormats, which are collectively processed and marketed. With a greater volume and wider range of products, the organization has a stronger negotiating position than individual producers. [...]
The beating and decorticating machines are operated by the organization's management. Members receive an individual supply of fibre daily which they process into rope using their twining machines. The organization then buys back the rope (deducting the cost of the fibre) which is processed into various products, such as doormats and textiles. The manufacturing of end-products in the community itself increases employment opportunities for a large number of non-members. The rope-making machines and collective marketing, have allowed the women to enhance their productivity, and as a result to increase in their incomes by up to US$1 per day. Encouraged by their success, the organization has tripled its capacity by investing in additional beating and decorticating machines. The increased income from coco-based products has encouraged farmers to value their plantations more highly and to conserve their coconut palms, contributing to the maintenance of coconut genetic diversity." (Kruijssen, Keizer and Giuliani, 2008).

4.4 Total income and income diversification

We have now analysed all income generating interventions separately and have seen some inconclusive and contradictory results. We will therefore examine total household income and the influence of the project on it. We first compare mean total income between baseline and post-project by country and community (Table 15). We find a significant increase for 9 out 14 communities and also at the global level.

Total income is composed of income derived from coconut, intercrop, livestock, other on-farm, off-farm and non-farm activities. As we have seen in Figure 2 in Section 3.2 the price of coconut has increased rapidly over the years of the project. To assess whether world prices are transmitted along the coconut chain and are reflected in domestic prices, we assess the price trends of the Philippines, for which reliable data is available from the Philippine Coconut Authority. We compare the price trend of the export price of coconut oil with domestic mill gate prices for copra (from which the oil is derived). From Figure 3, we find that price trends are indeed transmitted, with prices following a similar pattern.

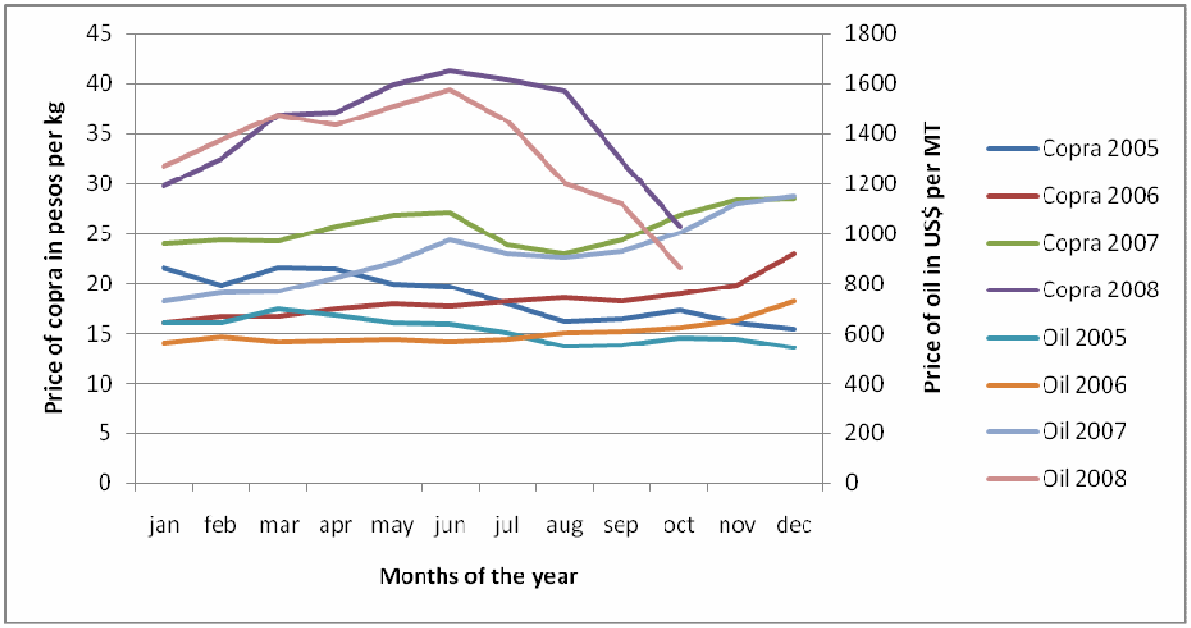

Figure 3. Price trends for copra and coconut oil 2005-2008

The fluctuations in coconut price are likely to bias the outcomes of the analysis of household income derived from coconut. We need to include a variable that represents the world coconut oil price. However, because the value will be identical for all households in each community this leads to collinearity between this variable and the variable that represents the project in the estimation. We will therefore adjust income for the fluctuations in coconut price. Because we do not have a complete overview of the coconut prices in the individual project sites, we have assumed that all prices will follow the general trends in the development of coconut oil world prices.

To correct income derived from coconut we have adjusted all coconut incomes for the growth rate of the world price of coconut oil (minus inflation). As data collection did not occur at the same time in all countries we calculated the growth rate for the appropriate period for each individual country. The adjusted coconut income was then added to income derived from other sources to calculate (adjusted) total income. This corrected total income is used in further analyses. Table 15 shows an overview of the comparison of means of total unadjusted and adjusted household income. In one case (Tunkalan, Philippines) the income adjustment has lead to the difference in mean of total income before and after the project changing from significant to insignificant. Overall, four out of seven countries and eight out of fourteen communities have shown a significant difference in mean between the baseline and post-project total adjusted household income.

Table 15. Comparison of means of total unadjusted and adjusted household income

	Baseline				Post-project unadjusted			Post-project adjusted		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sig.**	**Mean**	**SD**	**Sig.**
Ghana	**41**	**1316.93**	**1056.65**	**41**	**1276.18**	**1110.76**		**1068.08**	**911.39**	
India	**150**	**1749.93**	**847.44**	**150**	**3952.55**	**2071.70**	***	**3685.89**	**1929.91**	***
Pathiyoor	50	1695.94	953.81	50	4316.22	2676.11	***	3906.38	2412.00	***
Devikulangara	50	1750.91	802.72	50	3409.34	1674.56	***	3249.28	1641.61	***
Thodiyoor	50	1802.93	789.81	50	4132.09	1617.52	***	3902.00	1587.84	***
Malaysia	**57**	**3907.85**	**2919.68**	**35**	**5267.70**	**4663.74**		**4949.39**	**4435.68**	
Mexico	**32**	**3462.42**	**2010.12**	**29**	**3826.65**	**1619.67**		**3224.53**	**1533.56**	
Philippines	**87**	**2325.56**	**2235.58**	**84**	**3887.26**	**3618.33**	***	**3140.48**	**2990.62**	**
San Miguel	35	1412.82	1009.25	35	1511.17	1236.07		1293.10	1137.21	
Tunkalan	52	2939.91	2606.16	49	5584.47	3807.79	***	4460.03	3206.75	**
Thailand	**138**	**5561.01**	**4854.08**	**163**	**9893.87**	**9339.01**	***	**8452.02**	**7498.92**	***
Khog Wauw	50	5774.89	3666.13	52	7471.96	6543.66		7461.29	6533.42	
Thungka	53	4421.45	3403.49	56	6532.26	4996.02	**	5454.63	4415.90	
Saeng Arun	35	6981.08	7327.19	55	15606.41	12049.20	***	12440.60	9058.70	***
Vietnam	**63**	**1773.34**	**824.69**	**76**	**3705.60**	**1759.32**	***	**3291.04**	**824.69**	***
Binh Khanh Tay	21	1378.04	752.49	19	3335.85	1359.54	***	2937.36	1246.82	***
Chau Binh	21	2307.48	747.44	30	4073.35	1768.19	***	3842.41	1741.96	***
Duc My	21	1634.49	706.80	27	3557.18	1970.48	***	2927.30	1501.36	***
All	**568**	**3048.40**	**3224.90**	**578**	**5469.56**	**6137.24**	***	**4766.46**	**5059.87**	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Because the project has most likely changed the composition of total household income we also examine the Herfindahl index, which is an index that indicates the economic diversity of a household. It is calculated as the sum of the squared shares of income from each activity (in this case coconut, intercrops, livestock, other on-farm, off-farm and non-farm). The index always takes a value between zero and one, whereby one represents complete specialization. Table16 shows an overview of the comparison of the mean Herfindahl index by country and community before and after the project. Out of fourteen communities, six have seen a significant diversification of their income, while one community has become more specialized. At the global level we also find a significant diversification of income.

Table 16. Comparison of means of income diversification (Herfindahl index)

	Baseline			Post-project			
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sign.**
Ghana	**41**	**.71**	**.24**	**41**	**.41**	**.14**	***
India	**150**	**.70**	**.16**	**150**	**.57**	**.17**	***
Pathiyoor	50	.73	.19	50	.54	.16	***
Devikulangara	50	.66	.15	50	.67	.16	
Thodiyoor	50	.72	.13	50	.51	.13	***
Malaysia	**57**	**.66**	**.20**	**35**	**.66**	**.20**	
Mexico	**32**	**.54**	**.15**	**29**	**.52**	**.12**	
Philippines	**87**	**.57**	**.21**	**85**	**.48**	**.25**	***
San Miguel	35	.64	.24	35	.53	.34	
Tunkalan	52	.53	.18	50	.44	.17	**
Thailand	**134**	**.68**	**.24**	**163**	**.58**	**.20**	***
Khog Wauw	48	.70	.23	52	.61	.20	**
Thungka	53	.62	.24	56	.57	.20	
Saeng Arun	33	.73	.23	55	.56	.21	***
Vietnam	**63**	**.52**	**.18**	**76**	**.53**	**.20**	
Binh Khanh Tay	21	.61	.22	19	.61	.23	
Chau Binh	21	.46	.15	30	.57	.21	*
Duc My	21	.48	.15	27	.44	.13	
All	**564**	**.64**	**.21**	**579**	**.55**	**.20**	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Table 17 presents the results of the second stage regressions with the Inverse Mills Ratio at global, country and community level. At the global level we find that the project positively influences expected total household income by 1778.06 international dollar. A higher level of education and more available land also positively influence total income. There is geographic differentiation indicated by the significance of the community variable. The occurrence of natural calamities (indicated with a negative value) negatively influences expected total income by 6009.91 international dollar.

At the national level we find that for four out of seven countries the project positively influences expected total household income (India by 1561.71 international dollars, Philippines by 835.57 dollar, Thailand by 1995.60 dollar and Vietnam by 1518.35 dollar). At the community level this is 8 out of 14 communities (including Ghana, Malaysia and Mexico where the project was carried out in only one community). Household size is a significant variable in many of the regressions, and it positively influences total household income in all cases, apart from one Indian community. In some communities, gender of the household head plays a role, where having a female head of household is negatively influencing total household income (Ghana, Thodiyoor India, and Thungka Thailand). Farm size also positively influences household income in many communities. The Herfindahl index is significant in many of the regressions, and while diversification positively influences household income, this situation is reverse in two of the Vietnamese communities (where specialization positively influences expected total income). The Inverse Mills Ratio is significant in 10 out of 18 regressions, showing bias in the sample.

Table 17. OLS with IMR and dependent variable total income

Explanatory variable	All			Ghana			India			Pathiyoor - India			Devikulangara - India		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	1778.06	258.74	***	-359.43	278.87		1561.71	165.08	***	1993.75	349.16	***	1524.88	243.68	***
Community	491.14	42.38	***										162.69	101.35	
Household size				34.09	27.68		111.87	47.73	**	-143.18	87.77				
Education head	456.38	93.08	***				174.15	72.35	**	104.78	301.32				
Religion: Hindu													575.42	375.69	
Gender head				-505.78	214.34	**									
Farm size							3089.09	547.03	***	6938.20	918.64	***			
Land area coconut	465.42	45.63	***												
Natural calamity	6009.91	773.48	***												
Herfindahl index	374.05	1231.30		-2756.59	997.67	***									
Inverse Mills Ratio	-1905.82	1079.25	*	640.87	291.06	**	-1556.59	253.50	***	-387.80	348.11		10594.61	3972.97	***
Constant	294.85	634.99		2272.74	479.17	***	1897.32	389.88	***	1867.36	628.73	***	-7914.66	3096.18	**
Adjusted R-square			.337			.154			.445			.534			.332
Durbin Watson			1.613			2.121			1.556			1.464			1.941

Explanatory variable	Thodiyoor - India			Malaysia			Philippines			San Miguel - Philippines			Tunkalan - Philippines		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	1719.80	316.06	***	985.55	749.07		835.57	419.57	**	38.18	314.67		1108.43	616.97	*
Community							2265.55	446.99	***						
Household size	192.93	70.29	***				252.71	110.55	**						
Education head	243.63	139.96	*							-177.91	136.68				
Religion: Christian										-2018.49	998.53	*			
Gender head	34.40	239.00											674.80	167.79	***
Farm size				446.22	137.49	***	653.76	138.97	***	461.13	322.02		6528.68	4171.88	
Herfindahl index													-6928.61	3139.87	**
Inverse Mills Ratio	-439.94	236.94	*	1836.78	1955.60		-1974.12	1372.18		-128.75	533.35		5101.50	1604.27	***
Constant	772.77	630.27		-134.07	2419.08		-15774.86	3853.63	***	2832.08	1476.48	*	1108.43	616.97	*
Adjusted R-square			.499			.096			.293			.079			.207
Durbin Watson			1.581			2.337			2.170			1.484			2.203

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Table 17 continued. OLS with IMR and dependent variable total income

Explanatory variable	Thailand			Khog Wauw - Thailand			Thungka - Thailand			Saeng Arun - Thailand		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	1995.60	721.55	***	915.48	1121.88		931.61	794.49		3071.75	1763.32	*
Education head							1264.42	344.93	***			
Religion: Buddhist	-2671.09	1414.81	*									
Gender head	-917.46	733.94					-2981.09	1106.25	***			
Status	2136.97	1447.70								3390.45	3107.63	
Farm size	496.36	82.95	***	824.04	315.46	**				606.88	115.66	***
Herfindahl index				-8661.08	3156.41	***						
Inverse Mills Ratio	-3750.74	1728.41	**	1301.04	2077.98		-5142.67	1809.22	***	-8202.57	3118.78	**
Constant	8547.02	2301.81	***	9688.86	2040.99	***	7027.95	1678.11	***	7987.27	3340.54	**
Adjusted R-square			.217			.141			.101			.299
Durbin Watson			1.764			1.802			1.973			1.931

Explanatory variable	Vietnam			Bhinh Khanh Tay - Vietnam			Chau Binh - Vietnam			Duc My - Vietnam		
	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig	Coef.	S.E.	Sig
Project	1518.35	204.46	***	1369.46	311.23	***	1732.36	369.55	***	1111.05	355.33	***
Community	-251.55	127.33	*									
Household size	116.58	81.30		599.15	155.83	***	566.49	399.04		306.88	113.08	**
Education head				1887.38	575.89	***	446.51	342.48				
Farm size	1942.24	292.12	***				1022.14	689.54		1101.99	622.45	*
Herfindahl index				2104.43	880.38	**	4333.48	2183.30	*			
Inverse Mills Ratio	-152.08	346.39		5368.97	1664.14	***	3345.52	1792.40	*	-678.04	469.31	
Constant	3794.74	1744.47	**	-9637.15	3030.07	***	-5913.81	3902.04		316.31	700.51	
Adjusted R-square			.450			.529			.466			.345
Durbin Watson			2.048			2.076			2.198			2.293

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

4.5 Community nurseries

This intervention aimed to identify, characterize and document local high yielding and high value coconut varieties, to improve access to high quality planting material, and raise awareness among farmers of valuable coconut varieties and promote their use on-farm. The documentation and characterization of plant genetic resources is important to make these resources useful for farmers, breeders and researchers. Important activities were the identification, characterization and documentation of high value and high yielding local coconut varieties in the communities. Community-managed nurseries were then established where these varieties were propagated, to provide communities with access to this coconut germplasm. At the same time, the nurseries provide an important step towards in-situ conservation of high value and high yielding coconut varieties, through building capacity for management of these resources at the community level. This intervention had four main outputs: (1) catalogues of coconut varieties identified and characterized, (2) farmers trained in community nursery management and plant breeding (3) nurseries established and (4) planting material propagated and distributed to farmers.

To have a better understanding of the coconut production systems in the participating countries Table 18 presents a comparison of the mean land area under coconut, the total number of coconut trees and the number of trees per hectare of coconut area, by baseline and post-project.

Table 18. Overview of comparison of means of coconut production variables

	Land area coconut			**Total number of coconut trees planted**			**Number of trees per hectare**		
	Baseline	**Post-project**	**Sig**	**Baseline**	**Post-project**	**Sig**	**Baseline**	**Post-project**	**Sig**
Ghana	**.93**	**.83**		**304.84**	**242.70**		**277.79**	**248.24**	
India	**.08**	**.08**		**16.93**	**18.43**		**419.94**	**449.83**	
Pathiyoor	.09	.10		16.40	17.40		237.67	227.08	
Devikulangara	.09	.09		19.02	21.92		670.54	763.99	
Thodiyoor	.07	.07		15.36	15.96		351.61	358.42	
Malaysia	**1.88**	**1.95**		**247.77**	**218.17**		**128.03**	**118.10**	
Mexico	**4.99**	**4.54**		**620.16**	**594.07**		**124.37**	**131.50**	
Philippines	**1.59**	**.**		**163.58**	**1901.40**	***	**108.83**	**.**	
San Miguel	2.07	.		137.14	4364.55	***	67.85	.	
Tunkalan	1.35	.		178.38	171.96		133.98	.	
Thailand	**1.49**	**2.17**		**211.00**	**302.99**		**156.87**	**138.32**	
Khog Wauw	.11	.10		10.85	11.09		24.57	69.05	**
Thungka	1.32	1.82	*	171.47	267.64	*	148.11	146.44	
Saeng Arun	3.51	4.44		523.78	604.23		206.39	144.85	
Vietnam	**.33**	**.28**		**54.30**	**41.57**	*	**162.66**	**163.93**	
Binh Khanh Tay	.19	.18		29.43	32.05		154.56	175.36	
Chau Binh	.42	.32		72.95	54.20		175.85	177.10	
Duc My	.38	.32		62.16	38.81	*	157.02	144.92	
All	**1.19**	**1.30**		**166.68**	**432.88**	***	**234.42**	**257.12**	

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

While the mean area under coconut has remained constant in all communities but one (Saeng Arun in Thailand) we see a significant difference in mean number of coconut trees before and

after the project for four communities and at the global level. For the two Vietnamese communities this is a reduction of number of coconut trees, the change in number of trees per hectare however is not significant. Number of trees per hectare is only significantly higher for one community, Khog Wauw in Thailand. This is due to the scarcity of available land in this community and the fact that farmers also plant coconut trees in public areas and at their relatives' farms.

Table 19 shows an overview of the number of varieties identified in farmers' fields before and after the project. Six communities and all countries together show significant differences in the mean absolute number of coconut varieties before and after the project, which is again a reduction in the case of the community Chau Binh in Vietnam. Mean number of varieties per hectare however, only shows a significant change at the global level and for one of the Thai communities. It is possible that the significant difference is related to the improved ability of farmers to recognize and name varieties instead of an actual increase in number of varieties planted on farm. We do not show data on yields as the end of the project is too recent to measure the impact on this variable (new plants have yet to bear fruits).

Table 19. Overview of comparison of means of number of varieties

	Total number of coconut varieties			**Number of varieties per hectare**		
	Baseline	**Post-project**	**Sig**	**Baseline**	**Post-project**	**Sig**
Ghana	**1.11**	**1.08**		**1.14**	**1.26**	
India	**1.02**	**1.25**	**	**28.16**	**36.17**	
Pathiyoor	.90	1.37	**	17.16	25.37	
Devikulangara	1.10	1.26		46.82	53.75	
Thodiyoor	1.30	1.13		42.50	27.72	
Malaysia	**1.00**	**1.11**		**.99**	**.87**	
Mexico	**1.53**	**1.52**		**.41**	**.44**	
Philippines	**1.16**	**1.58**	***	**1.05**	**.**	
San Miguel	1.25	1.24		.64	.	
Tunkalan	1.12	1.70	***	1.30	.	
Thailand	**.87**	**1.36**	***	**1.28**	**2.22**	**
Khog Wauw	.78	1.18	**	2.32	7.40	**
Thungka	.86	1.41	***	1.13	1.48	
Saeng Arun	1.00	1.46	***	1.13	1.91	
Vietnam	**1.41**	**1.01**	***	**7.21**	**6.33**	
Binh Khanh Tay	1.43	1.32		12.42	8.26	
Chau Binh	1.52	.77	***	3.96	3.93	
Duc My	1.29	1.07		5.04	7.62	
All	**1.09**	**1.28**	***	**5.61**	**10.61**	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

A significantly negative correlation exists between the area under coconut and the number of trees per hectare (correlation coefficients -.128, significance level 0.01), implying that the plant density is higher at farms with smaller plots. There is also a significantly negative correlation between the total area planted with coconut and the number of varieties per hectare (correlation coefficients -.180, significance level 0.01) while there is a significantly positive correlation between the total area planted with coconut and the total number of varieties planted (correlation coefficients .138, significance level 0.01). These two findings together imply that although an

increase in coconut area is likely to lead to an increase in number of coconut varieties planted, there is decrease in marginal returns, which means that with each unit of land expansion, the increase in number of varieties becomes less.

The intervention was implemented through CBO's. Training on nursery management and plant breeding was conducted, with participation of a total of 941 farmers of which 41 percent is women (see Table 20). Coconut farmers are involved in the management of the nurseries by participating in seednut selection, nursery establishment activities such as fencing, maintenance such as weeding, watering, polybagging and selling of seedlings and collection of repayments. A total of 226 CBO-members are involved in nursery management operations, of which 30 percent is women (also shown in Table 20).

Table 20. Participation in nursery management activities by country

	Participants in training on nursery management and plant breeding					Involvement in nursery management				
	Male		Female		Total	Male		Female		Total
Country	No.	%	No.	%	No.	No.	%	No.	%	No.
China	59	57%	45	43%	104	3	100%	0	0%	3
Ghana	5	100%	0	0%	5	10	91%	1	9%	11
India	55	49%	58	51%	113	5	100%	0	0%	5
Indonesia	68	99%	1	1%	69	68	99%	1	1%	69
Malaysia	0	-	0	-	0	14	64%	8	36%	22
Mexico	8	50%	8	50%	16	3	75%	1	25%	4
Philippines	84	54%	73	46%	157	13	62%	8	38%	21
Tanzania	63	66%	32	34%	95	17	57%	13	43%	30
Thailand	32	39%	50	61%	82	4	57%	3	43%	7
Vietnam	178	59%	122	41%	300	22	41%	32	59%	54
Total	**552**	**59%**	**389**	**41%**	**941**	**159**	**70%**	**67**	**30%**	**226**

Source: Country project reports.

Through a participatory approach with farmers, local high value and high yielding coconut varieties were selected. Table 21 shows an overview of the number and names of coconut varieties that were identified and characterized, the number of nurseries established and the manner in which they are managed (individual vs. CBO), and the number of seedlings that were distributed to the farmers in the communities. A total of 48 coconut varieties were identified in ten countries through participatory processes, and characterized and documented. The ten countries established 36 nurseries (16 individual, 20 at CBO level) which together distributed 12265 seedlings to both CBO members and non-members in the communities.

Table 21. Coconut varieties identified, nurseries established and seedlings distributed

Country	Nr of varieties charac-terized	High yielding and high value varieties	Nursery implementation		Nr of seed-lings planted
			Indi-vidual	CBO	
China	4	Hainan Green Tall, Hainan Yellow Dwarf, Hainan Red Dwarf, Aromatic Dwarf	5	0	180
Ghana	5	Kukue Anyele-high yielding variety, Kukue Mbole-big nut variety, sweet variety, thick shell variety, thick husk variety	0	1	200
India	6	West Coast Tall, Chowghat Orange Dwarf, Chowghat Green Dwarf	0	3	1600
Indonesia	7	Sindangjaya 1 (yellowish - coastal), Sindangjaya 2 (greenish - coastal), Sindangjaya 3 (yellowish - mountainous); Sindangjaya 4 (greenish - mountainous), Sei Ara 1 (greenish), Sei Ara 2 (reddish), Sei Ara 3 (yellowish)	2	0	670
Malaysia	2	Malayan Red Dwarf, Sabah Local Tall	0	4	480
Mexico	4	San Rafael Tall, El Pailebot Tall, Sanchez Magallanes Tall, San Luis – San Pedro Tall	2	0	340
Philippines	7	Laguna Tall, Laguna Dwarf, Catigan dwarf, Tacunan Dwarf, Makapuno	0	3	2350
Tanzania	2	East African Tall, Pemba Red Dwarf	5	3	200
Thailand	5	Nam Hom (Aromatic Green Dwarf), Tap Sakae, Ka Lok, Thai Red Dwarf, Thalai Roi	0	3	1125
Vietnam	6	Dau Red Tall, Dau Yellow Tall, Ta Lua Tall, Green Ta Tall, Fired Bung Tall, Yang Lun Ta Tall, Xanh Lun Ta Tall, Sap Tall Makapuno	2	3	5120
TOTAL	**48**		**16**	**20**	**12265**

Source: Annual project reports 2006, 2007; Project data analysis workshop (June 2008).

Documentation of the identified local varieties and their characteristics is important to ensure the continued use of these varieties by farmers and breeders. Methods of identifying, documenting and promoting high value and high yielding local varieties included farmers' meetings, biodiversity fairs, field days, and catalogues. We will expand on this subject in section 4.7 (knowledge dissemination and networking) as these activities also served other purposes.

The availability of affordable and high quality planting material has improved due to the existence of the nurseries. The prices of planting material from CBO-managed nurseries in Mexico, Philippines and Vietnam are 57, 25 and 43 percent lower than private or governmental nurseries. This has improved farmer options. Participating farmers have also increased their awareness on the availability of local disease-tolerant and high-yielding varieties which will lead to improved use of these varieties (Table 22).

Table 22. Price differences in USD between (new) CBO nurseries and other nurseries

Country	Price of seedling by nursery (USD)		Price difference	
	private / government owned	new CBO nurseries	USD	%
Mexico	7.00	3.00	-4.00	-57%
Philippines	1.00	0.75	-0.25	-25%
Vietnam	1.75	1.00	-0.75	-43%

Source: Country project reports

Project partners indicated several constraints to the establishment and management of the nurseries, such as:

- Susceptibility to pest (Brontispa, mealy bug) and diseases (lethal yellowing) of coconut varieties
- Occurrence of natural calamities such as typhoons, drought, cold weather, and sea water invasion which destroyed new plants
- Preference to early bearing varieties (hybrids and local dwarfs)
- Unavailability of good and early bearing varieties in some areas like Mexico.
- High prices of whole nuts (farmers prefer to sell nuts immediately, either as copra or whole nuts giving them immediate income rather than planting the seedlings in nurseries that need about 4 to 6 months before generating an income)
- Inaccessibility of the nursery sites due to poor road networks
- Lack of adequate number of mother palms due to root wilt disease in India
- Competition in resources from other crops such as rubber and oil palm.

The intervention is not specifically aimed at increasing income derived from coconut and we therefore cannot evaluate household coconut income. Most nurseries are run by the CBO and income derived from the nurseries has therefore not been measured at the household level.

4.6 Food security

The intercropping and livestock interventions had as a second output the improvement of food security and nutrition. Data on nutrition are not available and in this section we will therefore focus only on food security. Similar to the socio-economic data, there is a lack of counterfactual in the food security data. We will therefore assess the general trends in the food security situation from secondary data. The UN Millennium Development Goals (MDGs) Indicators website has data on the progress of all MDGs. As an indicator for food security we use the prevalence of under-weight children under the age of five which is shown in Figure 3.

It becomes clear from this figure that in all countries, apart from Indonesia and the Philippines there is a clear trend of decline in the prevalence of under-weight children. We will use these data to calculate the average trend in prevalence of under-weight children under five to compare with the project findings.

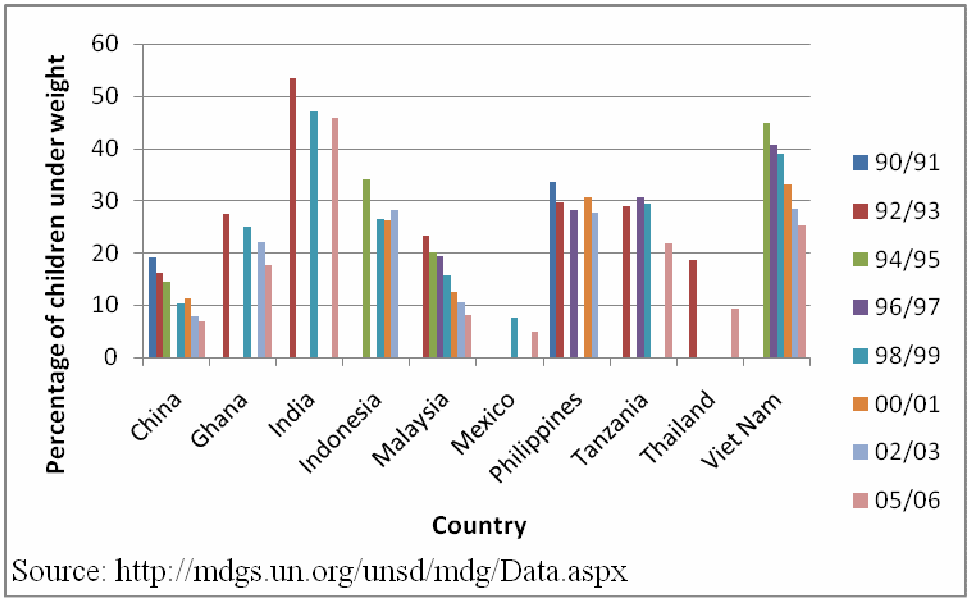

Figure 4. Prevalence of under-weight children under five years of age

We start by comparing mean monthly expenditure on food between baseline and post-project data. Unfortunately data on this variable is missing for many countries. The available data is presented in Table 23. Expenditure has seen a significant change in Ghana, all communities in India, and Mexico. Two of these are a significant increase. At the global level there is a significant decline in mean food expenditure. It is possible that the decline in expenditure is due to a higher availability of home grown food however, we are unable to show this with the available data.

Table 23. Comparison of mean monthly expenditure on food by country

	Baseline			Post-project			
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**Sign.**
Ghana	41	266.02	624.56	39	120.37	71.45	*
India	149	135.42	44.79	148	126.42	45.69	*
Pathiyoor	49	149.97	48.38	48	131.96	42.94	*
Devikulangara	50	129.11	37.37	50	93.09	31.35	***
Thodiyoor	50	127.47	45.31	50	154.43	39.32	***
Malaysia	57	180.10	66.40	35	165.35	91.72	
Mexico	32	181.45	35.97	29	207.38	17.37	***
Thailand	140	231.78	129.45	0	.	.	
Vietnam	0	.	.	76	171.16	77.74	
Total	419	189.99	215.71	327	147.44	67.85	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

The food security survey contained statements on the food security situation with the question for respondents to indicate whether in the last three months they experienced this situation never, sometimes or always:

1. I worry whether my food will run out before I get some more money to buy more
2. The food that I bought just didn't last and I didn't have money to get more

3. I ran out of the foods that I needed to put together a meal and I didn't have money to get more food
4. I cannot afford to give my child(ren) a balanced meal

The data were analysed using SPSS. The information for Indonesia is missing because the data for community Sindang Jaya is constant and for Sei Ara the baseline survey only contains five observations. Table 24 shows an overview of the percentage of respondents per community that have given the answer sometimes or always to the four questions above. A positive value in the columns with the header 'change' thus mean a deterioration in the food security situation. We also compare the results with national food security trends derived from the UN database on the Millennium Development Goals Data. The indicator used is the prevalence of underweight children below the age of five. Depending on the available data, the average change has been calculated over the years 1992-2006. Data of the project period were unfortunately not available, and we therefore have to assume that national food security trends have continued as they were before 2006.

The results show that of the ten countries, five have seen a significant change (t-test) in at least two of the food security situations, i.e. China, India (Pathiyoor, Devikulangara, Thodiyoor), Malaysia, Philippines (Tungkalan) and Tanzania. Also at the global level there is a significant improvement. Where the difference in mean was significant in the equality of means test, but the percentage change was below the national trend we have also indicated this as an insignificant change.

Table 24. Food security situations

Country	Community	N baseline/ post-project	Percentage that answered question with sometimes/always[1]												Average food insecurity change (%)[2]
			I worry whether my food will run out before I get money to buy new			The food that I bought didn't last and I had no money to buy new			I ran out of food to prepare a meal and I had no money to buy new			I cannot afford to give my child(ren) a balanced meal			
			base-line	post-project	change	base-line	post-project	change	base-line	post-project	change	base-line	post-project	change	
China	Qinlang	30/30	100	30	-70	100	20	-80	100	10	-90	100	23	-77	-1.7
Ghana	Nvuma	25/25	92	80	-12	96	64	-34	84	88	+4	80	76	-4	-1.6
India	Pathiyoor	25/25	28	0	-28	36	4	-32	36	4	-32	92	20	-72	-1.3
	Devikulangara	25/25	20	0	-20	40	12	-28	48	4	-44	88	32	-56	
	Thodiyoor	25/25	24	0	-24	36	12	-24	28	0	-28	96	32	-64	
Indonesia	Sindang Jaya	30/30	100	100	0	100	100	0	100	100	0	100	100	0	-1.5
Malaysia	Matunggong	21/21	100	10	-90	90	10	-80	43	0	-43	57	10	-47	-2.5
Mexico	B. Tabasquena	20/20	100	85	-15	100	100	0	80	90	+10	55	50	-5	-0.8
Philippines	Tungkalan	23/23	57	22	-35	57	26	-31	4	13	+9	17	17	0	-1.0
	San Isidro	34/34	94	94	0	71	91	+20	6	12	+6	47	15	-32	
	San Miguel	25/22	100	86	-14	96	55	-41	52	9	-43	80	68	-12	
Tanzania	Chambezi	30/30	90	50	-40	83	83	0	73	43	-30	53	37	-16	-1.2
Thailand	Khog Wuaw	25/25	0	4	+4	20	56	+36	12	4	-8	0	0	0	-1.6
	Seang-Arun	25/25	32	48	+14	28	36	+8	20	20	0	12	12	0	
	Thungka	25/25	36	36	0	20	32	+12	16	16	0	24	0	-24	
Vietnam	Binh Khanh T.	25/25	92	72	-20	72	88	+16	71	83	+12	83	67	-16	-3.9
	Chau Binh	23/23	100	96	-4	76	96	+30	83	70	-13	76	45	-31	
	Duc My	25/25	100	100	0	84	96	+12	79	76	-3	100	68	-32	
Total		**461/458**	**71**	**52**	**-19**	**67**	**55**	**-12**	**52**	**35**	**-19**	**65**	**37**	**-28**	

Note: [1]The columns show the percentage of respondents that answered the question with sometimes or always before and after the project and the percentage change. The red values show an insignificant change, or worsened situation. [2]Derived from: http://mdgs.un.org/unsd/mdg/Data.aspx accessed on 28 October 2008 (National data for 1990-2006, where available).

The survey also contained questions on the coping strategies households employed to deal with food shortages. Coping strategies should guard households against shocks and guarantee their food security and are activities that are directly attributed to the household (rather than external factors). While short-term coping strategies allow households to survive in short term, long-term strategies are those that lead to more structural improvement. Respondents were asked which of the following short-term coping mechanisms they were using: (1) borrowed money to buy food or got food on credit; (2) mother ate less; (3) father ate less; (4) modified eating patterns/ skipping meals; (5) substituted commonly bought foods with cheaper kind; (6) modified cooking method; and (7) mortgaged/sold assets. Furthermore they could choose the following long-term coping mechanisms: (8) homegarden/backyard gardening; (9) livestock/fish/poultry raising; and (10) food processing (drying, preserving, etc).

We first analyse whether the number of short-term and long-term coping strategies used has changed between the baseline and post-project data by using a simple t-test for equality of means (see Table 25). While 6 out of 17 communities have seen a significant decrease in the number of short term coping strategies employed and 1 community an increase, we find 6 communities with a significant increase in the number of long term strategies employed and 4 a decrease. At the global level we also see a decrease in the number of short term strategies used and an increase in number of long term strategies, which can be interpreted as an improvement in the ability of households to cope with food security shocks. We further analyse three types of coping strategies that are similar to the project interventions, i.e. homegarden (intercrops), livestock, poultry and fisheries and food processing. While the number of communities that have seen a significant increase in the use of the three strategies is almost similar (5, 5 and 4 respectively) is only for the homegarden strategy the increase also significant at the global level.

Table 25. Food security coping strategies

Country	Community	N	Mean total nr of strategies used						People using long-term coping strategy[1]					
			Short-term strategies			Long-term strategies			Homegarden		Livestock/ fishery/ poultry		Food processing	
			baseline	post-project	sign.	baseline	post-project	sign.	% change	sign.	% change	sign.	% change	sign.
China	Qinlang	30	3.77	.57	**	1.20	.27	**	-30.0	*	-53.0	**		
Ghana	Nvuma	25	4.36	3.68		1.36	1.72				+40.0	**	-24.0	*
India	Pathiyoor	25	2.04	.36	**	1.16	2.32	**	+44.0	**	+40.0	**	+32.0	*
	Devikulangaragara	25	1.36	.48	**	1.64	2.40	**	+32.0	*				
	Thodiyoor	25	1.40	.72	*	1.04	2.36	**	+60.0	**	+32.0	*	+40.0	**
Malaysia	Matunggong	21	.00	.24		.00	.24							
Mexico	B.Tabasquena	20	1.55	3.24	*	1.50	1.55						+25.0	*
Philippines	Tungkalan	23	2.13	.87	*	1.65	.57	**	-43.0	**	-43.5	**		
	San Isidro	34	1.50	1.62		1.62	1.88							
	San Miguel	25	3.4	3.4		1.56	1.36							
Tanzania	Chambezi	30	3.93	1.97	**	1.60	1.03							
Thailand	Khog Wuaw	25	1.24	.68		.00	1.11	**	-56.0	**	+48.0	**		
	Thungka	25	1.00	1.84		.16	1.04	**	+40.0	**	+36.0	**		
	Seang-Arun	25	1.48	.72		.12	.96	**	+32.0	*			+20.0	*
Vietnam	Binh Khanh Tay	25	4.72	4.40		1.64	1.64							
	Chau Binh	23	4.26	5.00		2.57	2.00	*						
	Duc My	25	5.0	4.96		2.68	1.56	**			-32.0	*	-48.0	**
All		461	2.54	1.97	***	1.19	1.33	*	+10.0	***				

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level. [1]Only significant changes have been indicated. The values indicate the change in percentage of the sample that is using the long-term coping strategy. E.g. in China 57% of the sample was using homegardens as a coping strategy, after the project this is 27% people, so the change is -30.0%.

4.7 Gender

The project was specifically designed to facilitate the inclusion of women in the activities however, this has been more successful in some countries than others. A total of 7146 farmers participated in trainings on intercrop production, livestock rearing, high value product production and marketing, nursery establishment and plant breeding, and CBO management. Of these participants 55 percent was female. In the individual sections above we already showed female participation in training to differ highly between country and topic. Participation of women in training on intercrops for example was 51 percent at the global level, however at the national level this ranged from 0% in Mexico and 3% Indonesia to 67% in India and 60% in Thailand. Participation of women in total training was found to be highest in India at 72% and lowest in Indonesia at 13%. In all other countries female participation was 43% or more. At global level, lowest female participation was found for training on nursery management, at 41% and highest for high value products, at 64%. Table 26 gives an overview.

Table 26. Participation in trainings by topic and gender

	Intercrops		Livestock		High value products		Nursery management		CBO management & micro-credit		Total				
Country	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**		**F**		**Total No.**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**Nr**	**%**	**Nr**	**%**	
China	57	43	57	43	41	59	57	43	50	50	294	53	264	47	558
Ghana	65	35	64	36	29	71	100	0	53	47	53	51	50	49	103
India	33	67	41	59	10	90	49	51	34	66	490	28	1240	72	1730
Indonesia	97	3	100	0	64	36	99	1	97	3	323	87	47	13	375
Malaysia	-	-	55	45	56	44	-	-	62	38	217	57	162	43	379
Mexico	100	0	0	100	27	73	50	50	41	59	62	39	99	61	161
Philippines	53	47	48	52	42	58	54	46	37	63	673	43	880	57	1553
Tanzania	54	46	58	42	53	47	66	34	53	47	289	57	222	43	511
Thailand	40	60	42	58	34	66	39	61	36	64	217	37	377	63	594
Vietnam	51	49	57	43	40	60	59	41	56	44	618	52	564	48	1182
Total	**49**	**51**	**53**	**47**	**36**	**64**	**59**	**41**	**42**	**58**	**3241**	**45**	**3905**	**55**	**7146**

Note: The number indicates total number trained, some individuals have been trained more than once, thus the total number of people trained can be higher than the total number participating.

4.8 Knowledge dissemination and networking

A last output of the project was knowledge dissemination and networking. For the identification of the high yielding and high value coconut varieties three methods were used, farmers' meetings, biodiversity fairs and farmer field days. Four main categories of research outputs are the catalogue of coconut varieties in which the characteristics of selected varieties are documented, scientific papers and presentations to reach the scientific community, extension material that communicates the interventions to policy makers and extension workers and the general media and a recipe book to reach the general audience. An overview of these products is shown in Table 27, a full list of publications coming forth from the project is given in Annex 15.

Table 27. Knowledge generation products

Activity	Message	Medium	Users	Uses
Farmers' Meeting	Dissemination of relevant information and resolution of important issues related to project implementation	Open discussion, small group discussion	• Extension workers • Farmers • Researchers • Government officials	Basis for planning
Biodiversity Fairs*	On-farm research	Use of Participatory Research Approach tools in the characterization of farmers varieties	• Extension workers • Farmers • Researchers • Government officials	Conservation and utilization of indigenous coconut varieties
Field Days	Dissemination and promotion of project outputs	Display of products Project brochures	• Extension workers • Farmers • Researchers • Government officials	For replication and up-scaling
Catalogue of coconut varieties*	Characteristics of identified varieties	IEC materials	• Extension workers • Farmers • Researchers • Policy makers	Basis in choice of planting materials & documentation of coconut genetic resources
Scientific papers, meetings	Dissemination of outputs	Scientific papers, posters, presentations	• Scientists • Students • Policy makers	Reference
Extension material	Dissemination of outputs	Posters, bulletins	• Extension workers • Policy makers	Reference
Other media	Dissemination of outputs	Radio broadcast, newspaper articles, video materials	• Farmers • Consumers • Policy makers	Public awareness
Recipe book	Coconut recipes from the project countries	Book	• Consumers	Public awareness

Note: *Only in China, India, Malaysia, Philippines, Tanzania, Thailand, Vietnam. Source: Annual project reports 2006, 2007; Project data analysis workshop (June 2008)

4.9 Bioversity International's role

The COGENT secretariat, situated at the Bioversity's Regional Office for Asia, the Pacific and Oceania, managed the implementation of the project. The main roles of the secretariat in this project were to provide:

- Scientific research methodologies
- Training of project coordinators and other national project staff
- Coordination and monitoring of project activities in all countries
- Facilitation of international networking
- Financial and project administration

Each project country had one main implementing agency which provided the national project coordinator and hosted the national administrative management. A list of these organisations and their type is shown in Table 28. These partners in turn worked with other national and local partners and the establishment of effective linkages for the upscaling of the project activities was part of the project outputs. A full list of collaborating partners is presented in Annex 16.

Table 28. Name and type of implementing agencies

Country	Implementing partner	Type of organisation	Nature of organisation	Geographical scope
China	Coconut Research Institute (CRICATAS)	NGO	Research	local
Ghana	Oil Palm Research Institute (OPRI)	Governmental	Research	national
India	Central Plantation Crops Research Institute (CPCRI)	Governmental	Research	national
Indonesia	Indonesian Center for Estate Crops Research and Development	Governmental	Research	national
Malaysia	Department of Agriculture (DOA)	Governmental	Research	national
Mexico	Instituto de Investigaciones Forestales, Agricolas y Pecuarias	Governmental	Research	regional
Philippines	Philippine Coconut Authority (PCA)	Governmental	Research, community development	regional
Tanzania	Ministry of Agriculture and Food Security (MAFS)	Governmental	Research	national
Thailand	Horticulture Research Institute (HRI)	Governmental	Research	national
Vietnam	Oil Plant Institute (OPI)	Governmental	Research	national

Source: partner survey, country reports

Table 29 shows an overview of the years in which partnerships were forged. Most partnerships date from after the start of COGENT (1992) and has a concentration around the time of preparation and implementation of the IFAD funded project evaluated in this paper (2004-2008). This indicates that Bioversity / COGENT has been important in the creation of partnerships and the mobilization of collective action.

Table 29. Formation of partnerships

Year	Frequency	Percent	Cumulative percent
1940	1	3.2	3.2
1979	2	6.5	9.7
1990	1	3.2	12.9
1993	4	12.9	25.8
1994	2	6.5	32.3
1996	1	3.2	35.5
1998	2	6.5	41.9
2002	1	3.2	45.2
2004	7	22.6	67.7
2005	8	25.8	93.5
2006	2	6.5	100.0
Total	**31**	**100.0**	

Source: partner survey

To evaluate the role of Bioversity as perceived by partners, a question was included in the partner survey in which partners were asked to put a value from one to five on each of the possible roles of Bioversity International, with one for least important and five for most important. The results are shown in Table 30. The highest score is given to the roles of fundraiser, mobilizer of collective action, and facilitator. The lowest score is given to the roles of researcher and enabler, although these still receive a rating of 'somewhat important'. When asked to name the nature of collaboration with Bioversity International the most frequent answers were however technical knowledge and capacity building. The collaboration with Bioversity is on average rated as very beneficial.

Table 30. Partners perception of Bioversity's role

Role	N	Minimum	Maximum	Mean	Median	Std. deviation	Rating[1]
Technical knowledge	10	3	5	4.30	4.00	.675	Somewhat important
Research	10	2	5	3.90	4.00	.876	Somewhat important
Mobilizing collective action	10	4	5	4.50	4.50	.527	Important
Fund raising	10	3	5	4.70	5.00	.675	Very important
Advocate	10	3	5	4.30	4.00	.675	Somewhat important
Catalyst	10	3	5	4.20	4.00	.632	Somewhat important
Facilitator	10	4	5	4.50	4.50	.527	Important
Enabler	10	3	5	4.00	4.00	.667	Somewhat important
Exposure	10	3	5	4.20	4.00	.632	Somewhat important
	Description of collaboration						
Benefit	8	3	5	4.63	5.00	.744	Very beneficial

Source: partner survey. Note: [1]Rating based on median value, because of categorical data.

When asked about their own work on coconut partners indicated the following activities (frequency of answer between brackets): coconut breeding, production, conservation and processing (5), project planning and conceptualization, monitoring and evaluation (1), socio-economic research (1), and extension (1). Their strongest role therefore is that of researcher, which complements the roles of Bioversity (as research is indicated as weakest). The partnerships developed are therefore important to reach the outputs aimed for in this project.

Strengths and weaknesses

The greatest achievements of the project at the national level, as indicated by the implementing agencies are (frequency of answer between brackets): mobilization of collective action in communities through CBOs for conservation and livelihood improvement (6), enterprise development (2), conservation and use of coconut genetic resources (2), empowerment of women (1), intercrop technologies (1), micro-credit system (1). The greatest achievement of the project corresponds with one of the most important roles of Bioversity, i.e. the role of mobilizing collective action.

When asked about their organization's own greatest achievements in coconut research (outside of the project) the answers were as follows: Coconut breeding (7), coconut cultivation (4), high

value products (3), transfer technology (2), extension (1), biotechnology (1), controlling pest Rhinchophorus palmarum (1). Thus, while the national partners already have strong capacity in traditional coconut conservation, cultivation and plant breeding, this project brought a novel approach based on livelihoods, which required collective action both at the community and international level.

The elements that need most improvement in the project, as indicated by project partners are: marketing and enterprise management (6), high value products production (5), micro-credit system (3), intercrops (2), livestock production (2), CBO management (1), participatory planning (1), and coconut planting techniques (1). The greatest weaknesses of the project are thus related to the market, which is also the area in which Bioversity has least experience.

Subjective assessment of counterfactual
Partners were also questioned about their subjective assessment of what had happened without intervention of Bioversity International. The following answers were given: Progress in coconut research and rural development would have been slower (3), Collective action would not have been mobilized internationally (3), Collective action would not have been mobilized locally (1), Impact on livelihoods of coconut work would not have been taken into account (1), lack of information (collection and conservation) (1).

4.10 Project benefit-cost ratio

In the previous sections we have quantified the market benefits reached by the project. We will use these analyses as the basis for the cost-benefit analysis of the project. Because estimating the benefit-cost ratio at the national level is complex as some of the costs and benefits are shared among all countries we will assess this ratio at the global level. As the private monetary benefit we use the value of 1778.06 international dollar that was estimated in the total income regressions of impact of the project on expected total household income. The total number of benefiting farmers is estimated at 1714, based on the number of members of each CBO. Total benefits are therefore 3,047,594.80 international dollars, assuming that all participating CBO-members have benefited equally.

The costs of the project, including project coordination and overhead were 1,259,120 US dollar consisting of 1 million from IFAD and 259,120 US dollar in counterpart funding. These investments were spread over the project period. Table 31 presents the actual investments at the time of the project by calendar year and the deflated and discounted costs per year. In order to fully assess the costs of the project we also need to take into account the costs incurred by farmers. Unfortunately data on labour and capital investment by farmers is not available. We therefore conduct a sensitivity analysis in which we will assess the benefit / costs ratio at different levels of labour investments. There is a total of 1714 farm households that benefit from the project. The assumption of the project has been that there is spare labour available in the households participating in the project. With an average household size of 4.8 and 1.4 children on average going to school and assuming that on average 0.5 person per household is not fit to work due to illness, or old or young age, we have an average of 2.9 household members available for work per household. We will conduct the analysis assuming that these active household members invest 5, 10 and 20 percent of their available labour time in project activities, with a day of farm-labour valued at 3.5 international dollars.

The costs and benefits at project and farmer level are summarized in Table 31. The project cost-benefit ratio is 2.35. The farmer cost-benefit ratio is 3.2, 1.6 and 0.8 at an investment of 5, 10, and 20% respectively. The critical boundary (where the farmer cost-benefit ratio is 1.0) is at an investment of 16% of total available household labour.

Table 31. Summary of costs and benefits of the project

	Deflated & discounted USD*	5% of total labour	10% of total labour	20% of total labour
Costs 2005 (half year)	402,266.57			
Costs 2006	446,288.75			
Costs 2007	310,477.55			
Costs 2008 (half year)	140,238.00			
Total project costs	1,299,270.87			
Total farmer costs		952,491.23	1,904,982.45	3,809,964.90
Total farmer benefits	3,047,594.80			
Benefit/cost ratio	**2.35**	**3.20**	**1.60**	**0.80**

Note: *A discount rate of 5% is applied.

We have not included non-market benefits such as the difficult to quantify benefits of the documentation and planting of coconut genetic resources and capacity building. The benefits have also been measured and estimated, immediately after the end of the project. This means that benefits are underestimated as they only represent one year. Benefits may diminish after the project is withdrawn, however if the interventions are sustainable in the long run (which can presently not be concluded) the benefits will be a multiplication of the amounts estimated in this report. In reality the benefit-cost ratio will therefore be higher than estimated here.

5 DISCUSSION AND CONCLUSIONS

5.1 Overview of outcomes

In Table 32 an overview is presented of the outcome indicators presented earlier. The table shows the significant coefficients for the project interventions in the regression with dependent variables intercrop, livestock, off-farm and total income and shows the cumulative outcome of the analysis of the food security situations. Due to the project survey design we were limited to the use of a 'reflexive comparison'. We have therefore used secondary data to construct statistical controls that can form the counterfactual. We have used a two-stage procedure to capture any observed and unobserved differences between the baseline and post-project sample, that are not caused by the project. In the first stage we estimated a probit function in which the dependent variable is a dichotomous variable that indicates measurement before or after the project. The Inverse Mills Ratio derived from this estimation was then used in the estimation of the equations for the outcome indicators. We have also adjusted total household income for fluctuations in coconut price which has seen a growth by a factor of 2.5 during the project period. For the counterfactual in the food security assessment we have used general national data on the trends in food security

in the individual countries and have compared them with the differences in food security situations as perceived by the project participants before and after the project.

Table 32. Summary of outcome indicators

Explanatory variables	Significant influence of project by income category[1]				Food security[2]
	Intercrop	Livestock	Off-farm	Total income	
Ghana					**0**
India	***105.53		**71.09	***1561.71	+4
Pathiyoor	**151.61		*94.45	***1993.75	+4
Devikulangara	***145.29			***1524.88	+4
Thodiyoor			*136.02	***1719.80	+4
Malaysia	**-129.84	***164.69			+4
Mexico					-1
Philippines	***840.81			**835.57	+1
San Miguel	***1279.46	***-517.51	***-203.65		+2
Tunkalan	***629.41			*1108.43	0
Thailand		***-555.78		***1995.60	-2
Khog Wauw	**60.17				-2
Thungka					-2
Saeng Arun		***-1713.72		*3071.75	-2
Vietnam			***655.70	***1518.35	-4
Binh Khanh Tay			***1671.49	***1369.46	-2
Chau Binh	***-178.18			***1732.36	0
Duc My	**190.57		**613.07	***1111.05	-2
All	***191.75			***1778.06	+4

Note: [1]These are the coefficients of the second stage regressions. Coefficient significant at the *0.10 level, **0.05 level, and the ***0.01 level. [2]Based on the change in occurrence of food security situations presented in Table 24, the indicated numbers are derived by giving a positive change the value 1, a negative change a value -1 and no change a value 0 for each situation and adding them for the four situations. The values marked in red show a decrease in income or food security. Empty cells have missing data or no effect (not significant).

Some countries have had a negatively influence on some of the income categories. This is most likely due to a shift in economic activities during the project. The column of food security shows the change in occurrence of food security situations. The indicated numbers are derived by giving a positive change the value 1, a negative change a value -1 and no change a value 0 for each situation and adding them for the four situations. For income and food security together, clearest impact has been reached in India, Philippines and at the global level. It is possible that impact has been underestimated due to data constraints.

The project was specifically designed to facilitate the inclusion of women in the activities however, this has been more successful in some countries than others. In the individual sections we showed female participation in training to differ highly between country and topic with female participation ranging from 0 to 100 percent. The total number of trainings A total of 7146 farmers participated in trainings on CBO management, intercrop production, livestock rearing, high value product production and marketing, and nursery establishment and plant breeding. Of these participants 55 percent was female. Participation of women in livestock trainings was 47 percent at the global level. At national level this ranged from 0 percent (Indonesia) and 36 percent (Ghana) to 100 percent (Mexico) and 59 percent (India). For intercrops this was 51 percent at the global level and at the national level this was found to be

lowest in Mexico (0%) and Indonesia (3%) and highest in India (67%) and Thailand (60%). For high value products 64 percent of the participants in training were women. At national level, female participation in training ranged from 36 percent in Indonesia to 90 percent in India.

By identifying, characterizing, and documenting local high yielding and high value coconut varieties, and improving access to high quality planting material through the establishment of community-managed nurseries on-farm conservation of coconut genetic resources is improved. This is supported by raising awareness among farmers of valuable coconut varieties. The documentation and characterization of plant genetic resources is important to make these resources useful for farmers, breeders and researchers. A total of 48 coconut varieties were identified in ten countries through participatory processes, and characterized and documented. A total of 36 nurseries were established which together distributed 12,265 seedlings. The impact on yield could not be measured as new seedlings are not bearing yet.

The project benefit-cost ratio of the project has been estimated at 2.35, based on present benefits and excluding non-market benefits such as documentation of genetic resources, skills development and food security improvement. A lack of data on farmer investments restricted the estimation of the farmer benefit-cost ratio. However, a sensitivity analysis revealed that the critical boundary where the costs are exactly equal to the benefits lies at an additional labour investment of 16% of total available household labour.

5.2 Constraints

There are large differences in impact between the countries and communities. This is both due to specific implementation problems in the communities and intervening factors outside of the control of the project. Many countries faced animal diseases such as Avian flu (Asia), foot and mouth disease and New Castle Disease (Tanzania). Access to veterinary services and quality breeder stocks was often limited resulting in unnecessary high mortality among livestock. Services are usually concentrated in higher potential areas. Capital requirements for the production of livestock were often too high to be carried by the micro-credit funds. Financial and asset barriers therefore often prevent small farmers from intensifying their production because the investment required often exceeds their capital wealth. Partners also indicate the micro-credit scheme as one of the major weaknesses of the project. This is largely related to a lack of proper CBO and micro-credit management. Thus, although CBO members were trained in these skills the capacity development was not sufficient to ensure the quality of management.

Plant diseases affected the productivity of intercrops planted and natural calamities such a hurricanes and volcano eruptions destroyed plants and coconut trees. In the regression at global level we found that the occurrence of natural calamities negatively influences expected total income by 6009.91 international dollar. Natural calamities and pests and diseases also affected the effectiveness of the establishment of the coconut nurseries because new plants were damaged or destroyed. Another important constraint for the nurseries was the lack of reliable sources of seednuts for the nurseries due to a high coconut price. Some communities were also hampered by a lack of infrastructure (such as roads and buildings). While effective linkages with both governmental and private sector partners were established in some countries, there has been a lack of government support in other countries, which has limited the effectiveness of the project.

Another obstacle in project implementation was marketing. Availability of market information to the resource-poor farmers was limited due to a lack of telecommunication and other information channels. As a result producers in remote areas are in general at a disadvantage in seeking markets and negotiating sales with traders and commercial firms. This problem was exacerbated by the fact that agricultural extension advice generally concerns technical production issues and little guidance is given on marketing issues. Agricultural extension staff require training to enable them provide advice on marketing issues as well as technical matters. There is also a need to encourage formation of collective action and participation by small-scale producers to strengthen their bargaining position. The development of the high value products was also indicated as a weakness in the project and competition with other products was indicated by partners to be high. More capacity building in marketing and production of high value products and better assistance and guidance to the CBO-members was necessary.

Farmers as the client of the interventions were involved in the planning, application and evaluation of the intervention strategies, in order to ensure their relevance to their situation. Research and extension benefited from farmer feedback and guidance in their work, at all levels, ensuring that the results of their work are useful and accessible to the farmers. Farmers benefited from regular and useful technical support (including training programmes and management of the revolving fund) generated by research and extension, which serves as the bases for sustainability of the project. However some partners have also indicated that the participatory process could have been improved to increase farmer involvement and commitment.

5.3 Weaknesses of the study

A major weakness of this study is that there is only data available from participants without a control-group of non-participants. To improve the reliability of this study it is recommended to collect data from non-participants in at least one site. Although this is still a weaker impact assessment option as there is no control-group of before the project, it would establish a better counterfactual (through Propensity Score Matching). Further research at a later stage could capture the medium- and long-term effects that cannot be measured immediately after the end of the project. Other data weaknesses include the lack of uniformity among countries in sample selection, data collection methods and data processing. The relatively small sample size also reduces the reliability. Better integration of the food security and socio-economic data linked with information on participation in specific interventions could also have greatly improved the quality of the impact assessment.

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ANNEXES

Annex 1: Project components, activities, outputs (according to project documents)

Component	Activities	Outputs
Measurement of impact	1. Establish CBOs 2. Conduct socio-economic and FSN surveys	1. 24 CBOs established 2. Baseline and post-project surveys conducted and analyzed
Community empowerment	3. Establishment of a microcredit system and initial revolving fund for each of the 24 community-managed CBOs 4. Development and implementation of farmers and women's action plans for income-generating activities. 5. Development of training manuals on income-generating technologies and instruments for analysis and promotion of viable technologies. 6. Training of coconut farmers, women and village-level entrepreneurs on income generating technologies.	3. Efficient CBO-managed microcredit system and initial revolving fund in support of community coconut-based enterprises established. 4. Empowered farmers and women's groups formed, demonstrated to be viable, and involved in managing on-farm and off-farm income-generating activities. 5. Training manuals published, disseminated and used in training. 6. Trained CBO members and leaders capable of managing rural business enterprises, and researchers and extension workers capable of supporting and replicating sustainable community-based income-generating activities and development efforts.
Income-generating interventions	7. Development of community-managed income-generating coconut seedling nurseries; and documentation, enhancement, characterization and conservation of promising selected local and introduced coconut varieties. 8. Evaluation of inexpensive village-level oil-mills and equipment for producing high-value coconut products. 9. Market surveys to identify marketable products and development of market channels to make these markets sustainable. 10. Development and viability testing of the production and marketing of identified marketable high-value coconut products from the kernel, husk, shell, water, wood and leaves; and promotion of varieties suitable for these products. 11. Pilot production and marketing of coconut high-value products from the kernel, husk, shell, wood, water and leaves.	7. Trained farmers are capable of identifying, characterizing, conserving and managing coconut genetic diversity to enhance incomes; profitable community-managed seedling nurseries; and well-documented, enhanced and conserved coconut genetic diversity in at least 24 coconut growing communities 8. Efficient and inexpensive village-level machinery and equipment for producing high-value products developed and adopted to benefit resource-poor coconut farmers and socioeconomically disadvantaged women. 9. Market surveys completed and new and larger consumer markets for coconut products, intercrops and livestock identified. 10. New viable income-generating on-farm and off-farm technologies utilizing various parts of the coconut from the kernel, husk, shell, wood, water and leaves disseminated and adopted. 11. Pilot production and marketing of coconut high-value

Component	Activities	Outputs
	12. Development and viability testing of coconut-based intercropping technologies for enhancing incomes and food security; and of livestock and fodder production for enhancing total farm productivity and nutrition.	products from the kernel, husk, shell, wood, water and leaves disseminated and adopted. 12. Viable intercropping and livestock/fodder production techniques that could enhance total farm productivity, food security and nutrition disseminated and adopted.
Knowledge dissemination and networking	13. Promoting the use of research results through field days and the replication and adoption of resulting viable development interventions by national governments, development organizations and non-governmental organizations. 14. Strengthening the 24 coconut growing communities and CBOs in ten countries to ensure sustainability. 15. Establish collaborative linkages with IFAD country portfolio managers, project managers of the Asian Development Bank (ADB), Global Environmental Facility – Small Grants Programme (GEF-SGP) and Common Fund for Commodities (CFC) and other development organizations in planning, implementation, monitoring, evaluation and impact assessment. 16. Publish techno guides and bulletins, articles in local dailies, scientific papers, and catalogues of food recipes, high value products and coconut varieties.	13. Farmer and extension field days organized; extension materials and public awareness materials in English and in national languages and dialects of participating countries published, disseminated and used. 14. At least 24 sustainable coconut-growing communities established in ten countries that can serve as models for replication nationwide by national programmes and bilateral investment projects of international development organizations. 15. Effective linkages established to support country investment projects of IFAD and those of ADB, GEF-SGP, CFC and other development organizations operating in the participating countries. 16. Techno guides published in all countries, at least 2 articles in each country, at least 1 scientific paper published, catalogues published (see annex 7)
Project administration	17. Purchase of computer sets, cameras and motorcycles (if applicable)	17. Equipment purchased

Annex 2: Template socio-economic questionnaire

Baseline Survey Information
PART A Socio-economic data
(AT THE START OF THE PROJECT)

COUNTRY: _____ PROJECT SITE: _____

Date: _____ Interviewer: _____

TO THE INTERVIEWER: PLEASE FILL UP THIS FORM COMPLETELY. DO NOT LEAVE ANY BLANK

GENERAL

(1) Name of head of household: _____
(2) Status: ☐ Single ☐ Married ☐ Others (*specify*):_____
(3) Age: _____
(4) Gender: ☐ M / ☐ F
(5) Number of Household Members: _____
(6) Education: ☐ Elementary ☐ Some High-School ☐ High-school ☐ Some College ☐ College ☐ Post-graduate ☐ No education ☐ Others (i.e., vocational), specify: _____
(7) Religion: _____
(8) No. of children going to school: _____

FARM INFORMATION

(9) Total Farm Area (*ha*): _____

Plot	Land ownership*	Range of Area in Hectare			
Coconut		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5
Rice		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5
Maize		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5
Others		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5
Others		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5
Total area		0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5

* i.e. land owner, tenant, farmworker

(10) No. of coconut trees planted on farm and age of trees

Age of trees	1-5 years	6-10	11-20	21-30	31-40	41-50	51-60	Over 70
Number of coconut trees								
Average yield (nr of nuts/tree/year)								

(11) Name(s) of coconut variety(ies) planted on your farm

Varieties Planted (Local Name)	No. of seedlings planted	Year of planting	Source of planting material

SKILLS/TRAINING ATTENDED

(12) a. List present skills related to farming/ agriculture:

_____

b. List other skills (e.g. masonry, carpentry, sewing etc):

_____

(13) Have you ever attended any skills development training seminar or workshop?
☐ Yes ☐ No
If **YES**, what were they about? _____

SOCIO-ECONOMIC INFORMATION

(14) Summary of Annual Income by classification ***(this portion is just the summary of the reported income below, so they should tally when totalled)***

Sources	**Amount**
On-farm (agricultural products produced on the farm) Coconut based (e.g. whole nuts) Others (e.g. rice, maize, vegetables, poultry)	
Off-farm (processed agricultural products) Coconut based (e.g. coco candy, handicrafts) Others (e.g. rice wine, dried mango)	
Non-farm (income from outside the farm)	
Total annual income	

Sources of Annual Income

(15) Coconut products produced *(i.e. copra, tender nuts, fibre, shell, etc.)* pls. specify the unit	Estimated Annual Income Derived (*local currency*):				
	Sold	Consumed	Paid in Kind	Stock/ Inventory	Total
1					
2					
3					
Sub-total					
(16) Other major intercrops planted in the coconut farm	Estimated Annual Income Derived (*local currency*):				
	Sold	Consumed	Paid in Kind	Stock/ Inventory	Total
1					
2					
3					
4					
Sub-total					
(17) Income from crops grown separate from the coconut farm	Estimated Annual Income Derived (*local currency*):				
	Sold	Consumed	Paid in Kind	Stock/ Inventory	Total
1					
2					

3					
4					
Sub-total					
(18) Livestock raised in your farm	Estimated Annual Income Derived (*local currency*):				
	Sold	Consumed	Paid in Kind	Stock/ Inventory	Total
1					
2					
3					
Sub-total					
(19) Off-farm income other than coconut based	Estimated Annual Income Derived (*local currency*):				
	Sold	Consumed	Paid in Kind	Stock/ Inventory	Total
1					
2					
3					
Sub-total					
(20) Non farm income (e.g. overseas remittance, public servant, pension)	Estimated Annual Income Derived (*local currency*):				
					Total
1					
2					
3					
Sub-total					
Total annual income					

SOCIO-CULTURAL PROFILE

Health Matter

(21) When a household member gets sick or ill, how often do you seek medical advice/ help/ service (*i.e., see a doctor, traditional healer or go to a clinic or hospital*)?

☐ Never ☐ Sometimes ☐ Frequently ☐ Always

Membership in Organisation(S)

(22) Before the project have you been or are you still a member of any farmers' cooperative or community based organization? ☐ Yes ☐ No

If **YES**, list the name(s) of the cooperative(s)/organization(s):

Name of coop/CBO	**Year**	**Active member**		**Position held**	**Reasons for joining/leaving**
		Yes	**No**		

Access to and Sources of Financial Capital

(23) Are you able to easily obtain loans for financing farm-related activities (e.g. to buy farm inputs, livestock)? ☐ Yes ☐ No

(24) From what source(s) do you obtain capital to finance you farm-related activity(ies)?

☐ Banks ☐ Microfinance/ microcredit ☐ Grants ☐ Subsidies
☐ Own capital ☐ Relatives ☐ Others (pls. specify):_____

If **YES**, list the name(s) of the organisation(s), coops or other financial institution(s), where you were able to obtain these loans from and the corresponding amount:

Organisation/credit facility/ other sources	Amount loaned	Interest rate	Amount Repaid

Living Indicators

(25) Please check the box that best describes your house at present:

☐ Thatched/palm frond roof, bamboo or wood walls and floors
☐ Wood or bamboo walls, concrete floor with thatched/ palm frond roof
☐ Wood or bamboo walls, concrete floor with galvanized iron roofing
☐ Mostly concrete with galvanized iron/ tile roofing and some wooden structure
☐ With utilities like water and electricity

(26) Ownership of the house

☐ owned ☐ rented ☐ staying with relatives

(27) Source of drinking water

☐ private well ☐ public artesian well ☐ pump ☐ piped pump ☐ bottled water ☐ others, specify:_____

(28) Source of power

☐ kerosene lamp ☐ LPG lamp ☐ electricity ☐ others, specify:_____

(29) Source of fuel of cooking

☐ fire wood ☐ kerosene/gas ☐ electricity ☐ biogas ☐ others, specify:_____

(30) Type of toilet facility

☐ none ☐ open-pit ☐ closed-pit ☐ flushed/water ☐others, specify:_____

(31) Please put a check beside the functional appliances that you presently have:

Item		Number of items	Mode of Acquisition	
			Bought	Given
☐	Radio			
☐	TV			
☐	Refrigerator			
☐	Gas stove			
☐	Electric stove			
☐	Wood / coal stove			
☐	Sewing machine			
☐	Telephone/Cell phone			
☐	DVD/VCD			
☐	Stereo cassette/CD player			
☐	Personal computer			
☐	Others			

(32) Please put a check beside the functional means of transport that you presently have:

Item		Number of items	Mode of Acquisition	
			Bought	Given
☐	Bicycle			
☐	Motorcycle			
☐	Car			
☐	Others			

(33) Please put a check beside the functional farm equipment/machinery that you presently have:

Items (indicate items)		Number of items	Mode of Acquisition	
			Bought	Given
☐				
☐				
☐				

(34) Household expenses

Particulars	Expenses/month
a. ☐ Food	
b. ☐ House rent	
c. ☐ Education	
d. ☐ Medical	
e. ☐ Utilities (i.e, electricity, water, etc)	
f. ☐ Others (specify)_____	
TOTAL	

GENDER AND DECISION MAKING

(35) Involvement of male and female of the household in the coconut farming and coconut processing activities?

Activity	Number of female(s)	Number of Male(s)
Coconut farming activities		
Coconut processing activities		

(36) Who makes the decision on the following? (Please identify)

Particulars	Decision maker (in the household)		
	Male	Female	Both
1. On how most of household income is spent	☐	☐	☐
2. In planting/replanting of coconut	☐	☐	☐
3. In cutting coconut trees	☐	☐	☐
4. On what intercrops or other crops to plant			
Vegetables	☐	☐	☐
Fruit trees	☐	☐	☐
Staple crops	☐	☐	☐
5. Livestock keeping			
Cattle	☐	☐	☐
Goats	☐	☐	☐
Other	☐	☐	☐
6. Poultry keeping	☐	☐	☐

7. Selling agricultural products			
Coconut (whole nuts)	☐	☐	☐
Processed coconut products (indicate):	☐	☐	☐
a.	☐	☐	☐
b.	☐	☐	☐
c.	☐	☐	☐
Vegetables	☐	☐	☐
Fruits	☐	☐	☐
Staple crops	☐	☐	☐
Livestock	☐	☐	☐
Whole animal			
Meat	☐	☐	☐
Milk	☐	☐	☐
Poultry	☐	☐	☐
Whole animal			
Eggs	☐	☐	☐
	☐	☐	☐

(37) If you are not the owner of the farm, does the land owner allow you to participate in this poverty reduction project?

☐ Yes ☐ No

If **YES**, under what conditions? _____

_____

_____

PERCEPTIONS ON THE PROJECT

(38) What are your expectations of the project?

Objective

☐ Income increase
☐ Food security enhancement
☐ Food nutrition improvement
☐ Increase biodiversity
☐ Others, specify:

(39) Do you think the coconut biodiversity conservation component of the project could help improve your COMMUNITY's economic condition? ☐ Yes ☐ No

If **YES**, in what way?

_____

If **NO**, Why?

_____

(40) Do you think maintaining/conserving the coconut varieties on your farm will improve your livelihood?

☐ Yes ☐ No

If **YES**, in what way can your coconut varieties contribute to the improvement of your livelihood?

_____ _____

- Thank you very much for answering this survey form -

Annex 3: Sampling strategies and data collection dates

Country	Sampling strategy	Collection strategy	Date baseline	Date post
China	Random selection from the CBOs	Sometimes farmers interviewed together, also door-to-door. Interviews conducted by team members, no interpreter was needed	Oct 05	Nov 07
Ghana	Interested CBO members after a group meeting	Local language not spoken by everyone so sometimes interpreters were needed. Interviews were conducted one-on-one	Oct 05	Feb 08
India	All CBO members interviewed. Data processed was 33% of total data collected. Stratified random sample for participation in the interventions	No interpreters were needed. Interviews were conducted door-to-door	May-Aug 06	March-Apr 08
Indonesia	Stratified random sample for CBO members (0-1 ha, 1-1.5 ha, 1.5-2 ha)	Door-to-door, no interpreter needed	Jan 06	Jan 08
Malaysia	Those CBO members that came to the meeting	Staff from the team and agricultural department, no interpreter was needed Baseline was conducted at the group meeting, post data was collected going door-to-door	March 06 and July 06	Nov 07
Mexico	All CBO members	No need for interpreters. Interviewer went door-to-door	Sept-Oct 05	Nov-Dec 07
Philippines	San Isidro: random selection CBO members and non CBO-members Tanjay: those present when PRA was conducted (baseline), Tungkalan: all members of the CBO	Tanjay: baseline at a group meeting but one-on-one interviews, post door-to-door (same respondents). Interviews conducted by local team that can speak the dialect Tungkalan: interviews conducted by provincial staff. Individual interviews, used local dialect.	San Isidro: Late 05 Tanjay: Oct-Nov 05 Tungkalan: Oct-Nov 05	San Isidro: not yet Tanjay: Feb-Apr 08 Tungkalan: Feb-Apr 08
Tanzania	Baseline was PRA. Post survey, 50% of CBO members. Random selection consisting of 90% CBO members, 10% non-CBO members	No interpreters needed. Interviews conducted by project team and hired interviewers. Door-to-door interviews	PRA in Oct 05	April 08
Thailand	All CBO members	No interpreters needed. Door-to-door interviews	April 06	Dec 07
Vietnam	Randomly selected from list of CBO members	No interpreters needed. Meeting was called but interviews conducted one-by-one	BKT: Jan 06 DM: March 06 CB: Jan 06	Jan 08

Source: project partner workshop (June 2008).

Annex 4: Partner questionnaire

Evaluating the implementation of the IFAD-COGENT project: poverty reduction in coconut growing communities

This questionnaire is conducted to assess the role of Bioversity International in the execution of the IFAD-COGENT poverty reduction project. Your answers to this questionnaire will only be used for the evaluation and will be kept strictly confidential.

A. GENERAL

A1. Questionnaire No.:_____

A2. Date and Time of interview: _____ From: _____To: _____

A3. Position of the Respondent:
□ 1.Management
□ 2.Scientist/field worker
□ 3.Administration
□ 4.Other (specify): _____

B. ORGANIZATIONAL DATA

B1. Geographical Location of the organization: _____

B2. Type of Organization:
□ 1.Government
□ 2.Parastatal (quasi-government)
□ 3.NGO
□ 4.CBO
□ 5.Private enterprise
□ 6.Private individual
□ 7.Other (Specify): _____

B3. Nature of organization's work:
□ 1.Research
□ 2.Rural/Community development
□ 3.Marketing
□ 4.Advocacy
□ 5.Other (Specify): _____

B4. Geographical scope of work:
□ 1.Regional
□ 2.National
□ 3.Local

C. INVOLVEMENT IN COCONUT

C1. How would you describe your work on coconut?

_____

_____

_____

C2. When did the organization/you get involved in coconut work? _____ (year)

C3. What would you describe as your (organization's) greatest achievement in the coconut work?

_____

_____

_____

D. INVOLVEMENT IN COCONUT

D1. How would you describe your work in the IFAD-COGENT project: "poverty reduction in coconut growing communities"?

_____

_____

_____

D2. What would you describe as your (organization's) greatest achievement in the IFAD-COGENT poverty reduction project in your country?

_____

_____

_____

D3. What elements of the IFAD-COGENT poverty reduction project could be improved in your country?

_____

_____

_____

E. INVOLVEMENT WITH BIOVERSITY INTERNATIONAL

E1. Have you collaborated with other organizations (including Bioversity International) in your coconut / poverty reduction work?

□ 1.Yes

□ 2.No (continue to E3)

E2. Use the Table below to fill in the nature of your past and present collaborations (extra sheets may be used if the space provided is not enough)

Name of Organization	Type of organization*	Period of collaboration**	Nature of collaboration***

CODES: *Type of organization: 1= Government, 2= Parastatal (quasi-government), 3= NGO, 4= CBO, 5= Private enterprise, 7= Private individual, 6= Other (specify); **Period of Collaboration: Example 1980-2003, or 2003 to 2007, etc.; ***Nature of collaboration: 1= Financial, 2= Technical 3=Advisory 4= Capacity building, 5= Other (Specify).

E3. How would you describe your collaboration with Bioversity?

□ 1.Very beneficial
□ 2.Fairly beneficial
□ 3.Beneficial
□ 4.Not very beneficial
□ 5.Not beneficial at all

E4. On a scale from 1-5, where would place each of the following roles of Bioversity in the IFAD-COGENT project? Note 1 is the lowest (least important) and 5 is the highest (most important)

a. Providing technical training: _____
b. Research: _____
c. Mobilising collective action: _____
d. Mobilising funds: _____
e. Advocacy: _____
f. Catalyst: _____
g. Facilitator: _____
h. Enabler: _____
i. Giving exposure: _____

E5. In your opinion what do you think the situation would be as far as coconut work in your country is concerned if Bioversity International was not involved at all?

_____

_____

_____

THANK YOU

Annex 5: Contemporaneous events

Factor	Remarks	Effect	Year	Country (community)*
Local government support	Project Support received from local government	+		China, Indonesia, Malaysia, Philippines, Tanzania, Thailand, Vietnam
	Procedural difficulties	-		India (Patiyoor)
	Low interest rates on loans	+		China, India, Indonesia, Malaysia, Mexico, Vietnam
	No access to loans	-		Ghana
	Incentive system	+		Philippines, Vietnam
Infrastructure	Electricity: not available	-		Ghana, Philippines (Tanjay), Tanzania, Thailand (Thungka), Vietnam
	Roads: problems with accessibility	-		Philippines, Tanzania, Vietnam
	New road built, improving market access	+	2006	Indonesia (Sindang Jaya)
	Buildings: work-shed	+		Ghana
	Buildings: processing facility built by government	+		Malaysia
	Buildings: storing facility not available	-		India
	Buildings: communal storage available	+		Thailand (Thungka)
	Communication: increased access by mobile phone (but some communities no electricity for charging)	+		all
Pests & diseases	Brontispa	-	2005	Vietnam
	Brontispa	-	2006	Indonesia
	Bird flu	-	2005	Vietnam
	Bird flu	-	2006	Indonesia
	Setora & Oryctes (insects)	-	2005-06	Indonesia
	Lethal yellowing disease	-	Increasing	Ghana, Tanzania
	Root wilt disease	-	All	India
	Coconut bug	-	Increasing	Tanzania
	Coconut mites	-	Increasing	India, Tanzania
	New Castle Disease (poultry)	-	Increasing	Tanzania
	Coconut beetle	-	All	Tanzania, Thailand, Vietnam
	Rhinophoras palmaram ceratositis (black beetle)	-	All	Mexico, Thailand, Vietnam
	Mealy bug	-	2006	Philippines (Tungkalan)
	Fusarium wilt (for ginger)	-	2006	Philippines (Tungkalan)
Natural calamity	Volcano eruption	-	2006-07	Philippines (Sorsogon)
	Typhoon	-	2006	Philippines (Sorsogon)

Factor	Remarks	Effect	Year	Country (community)*
	Typhoon	-	2008	China
	Flood	-	2005	Vietnam
	Drought	-	2005-06	Tanzania
	Drought	-	2006-07	Vietnam
	Seawater intrusion (salinity)	-	All	Vietnam
	Lack of drainage during heavy rains	-	2006	India
	Lack of drainage during heavy rains	-	2008	Tanzania
	Hurricane	-	2006	Vietnam
	Cold weather	-	2008	China
CBO management	Poor leadership skills	-		Philippines, Ghana, Mexico, Thailand (Thungka)
	Poor CBO financial management	-		Philippines (Tanjay)
	Limited entrepreneurial skills	-		Philippines, Tanzania, Vietnam
Other	Changes in climatic patterns	+/-		Ghana
	Slow down in activity due to local political elections	-	2007	Philippines (Tungkalan)
	Infrastructure established with support from other donors	+	2006-08	Philippines
	New projects started	+	2005-06	Vietnam
	Land ownership problems	-		Philippines (Tanjay)
	Limited land for coconut cultivation	-		India, Thailand (Khog Wuaw), Vietnam
	Coconut husk decorticator not working	-		Tanzania
	Problems in collective action	-		India
	Lack of quality seedlings	-		Vietnam
	Implementation of national coconut programs (planting & replanting)	+		Philippines, Vietnam

Source: project partner workshop (June 2008).

Annex 6. Area and production of coconut and coconut oil 2005-2007

Country	Area (in 1000 ha)			Coconut production (in 1000 metric tonnes)			Oil production (in 1000 metric tonnes)*		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Indonesia	2,710	2,650	2,620	18,250	16,375	17,000	1,508	1,358	1,258
Philippines	3,243	3,337	3,450	14,825	14,958	15,580	768	763	775
India	1,935	1,947	1,880	9,535	11,005	9,400	407	390	372
Thailand	265	258	255	1,871	1,815	1,705	156	157	154
Mexico	169	12	12	1,167	102	102	115	108	110
Vietnam	132	133	130	977	982	962	44	41	44
Malaysia	175	173	172	584	570	568	42	46	47
Tanzania	310	310	310	370	370	370	20	18	19
Ghana	55	55	55	315	315	316	7	7	7
China	29	28	255	280	290	307	0	0	0
World	10,784	10,668	10,899	57,958	55,300	54,716	3,441	3,269	3,162

Source: FAOSTAT, FAO Statistics Division, 21 October 2008.

Annex 7. Descriptive statistics explanatory variables per country

	All					Ghana					India				
Variable	**N**	**Min**	**Max**	**Mean**	**SD**	**N**	**Min**	**Max**	**Mean**	**SD**	**N**	**Min**	**Max**	**Mean**	**SD**
Site	1166	1	14	6.96	3.787	82	1	1	1.00	.00	300	2	4	3.00	.82
Data	1166	0	1	0.50	.500	82	0	1	.50	.50	300	0	1	.50	.50
Household size	1120	1	20	4.75	2.156	78	1	20	6.95	3.89	300	1	11	4.53	1.60
Age head	1143	17	89	45.58	12.660	73	18	77	41.16	12.60	300	18	70	45.39	11.28
No religion	1093	0	1	.07	.251	82	0	1	.07	.26	300	0	0	.00	.00
Religion: Christian	1093	0	1	.39	.489	82	0	1	.82	.38	300	0	1	.08	.27
Religion: Buddhist	1093	0	1	.28	.448	82	0	0	.00	.00	300	0	0	.00	.00
Religion: Hindu	1093	0	1	.17	.376	82	0	0	.00	.00	300	0	1	.62	.48
Religion: Muslim	1093	0	1	.09	.285	82	0	1	.11	.31	300	0	1	.29	.45
Education head	1154	0	6	2.02	1.323	82	0	5	1.33	1.46	296	0	5	2.69	1.06
Gender head	1160	0	1	.56	.496	82	0	1	.41	.49	300	0	1	.55	.49
Status head	1153	.00	1.00	.9124	.28283	82	0	1	.77	.42	300	0	1	.94	.23
Farm size	1139	0	46.4	2.24	3.599	82	.00	4.50	1.73	1.07	300	.01	1.00	.11	.1
Government supp.	1166	-1	1	.53	.649	82	0	0	.00	.00	300	-1	0	-.33	.47
Interest rate	1166	-1	1	.44	.622	82	-1	-1	-1.00	.00	300	1	1	1.00	.00
Electricity	1166	-1	0	-.35	.476	82	-1	-1	-1.00	.00	300	0	0	.00	.00
Roads	1166	-1	0	-.27	.443	82	0	0	.00	.00	300	0	0	.00	.00
Buildings	1166	-1	1	-.01	.710	82	1	1	1.00	.00	300	-1	-1	-1.00	.00
Plant disease	1166	-1	0	-.28	.448	82	-1	-1	-1.00	.00	300	0	0	.00	.00
Livestock disease	1166	-1	0	-.12	.324	82	0	0	.00	.00	300	0	0	.00	.00
Plant pests	1166	-1	0	-.79	.448	82	0	0	.00	.00	300	-1	-1	-1.00	.00
Natural calamity	1166	-1	0	-.12	.324	82	0	0	.00	.00	300	0	0	.00	.00
Income diversity	1143	.00	1.00	.59	.212	82	.24	1.00	.5623	.25	300	.23	1.00	.64	.18

Annex 7 continued. Descriptive statistics explanatory variables per country

	Malaysia					Mexico					Philippines				
Variable	**N**	**Min**	**Max**	**Mean**	**SD**	**N**	**Min**	**Max**	**Mean**	**SD**	**N**	**Min**	**Max**	**Mean**	**SD**
Site	92	5	5	5.00	.00	61	6	6	6.00	.00	173	7	8	7.60	.49
Data	92	0	1	.38	.49	61	0	1	.48	.50	173	0	1	.50	.50
Household size	92	2	14	6.16	2.44	61	1	13	4.87	2.69	141	1	10	4.71	1.90
Age head	92	25	71	45.96	11.35	61	23	74	47.25	12.53	166	22	79	52.05	13.66
No religion	92	0	1	.02	.14	61	0	0	.00	.00	166	0	1	.02	.13
Religion: Christian	92	0	1	.98	.14	61	1	1	1.00	.00	166	0	1	.98	.15
Religion: Buddhist	92	0	0	.00	.00	61	0	0	.00	.00	166	0	0	.00	.00
Religion: Hindu	92	0	0	.00	.00	61	0	0	.00	.00	166	0	0	.00	.00
Religion: Muslim	92	0	0	.00	.00	61	0	0	.00	.00	166	0	0	.00	.00
Education head	92	0	3	1.25	.96	61	0	5	1.61	1.03	165	0	5	2.04	1.32
Gender head	92	0	1	.28	.45	61	0	1	.23	.42	167	0	1	.54	.50
Status head	92	1	1	1.00	.00	61	0	1	.82	.38	160	0	1	.86	.35
Farm size	92	.40	14.23	4.9168	2.81	61	2.00	20.00	9.93	4.29	152	.50	10.00	2.37	1.56
Government supp.	92	1	1	1.00	.00	61	0	0	.00	.00	173	1	1	1.00	.00
Interest rate	92	1	1	1.00	.00	61	1	1	1.00	.00	173	0	0	.00	.00
Electricity	92	0	0	.00	.00	61	0	0	.00	.00	173	-1	0	-.40	.49
Roads	92	0	0	.00	.00	61	0	0	.00	.00	173	-1	-1	-1.00	.00
Buildings	92	1	1	1.00	.00	61	0	0	.00	.00	173	0	0	.00	.00
Plant disease	92	0	0	.00	.00	61	0	0	.00	.00	173	-1	0	-.60	.49
Livestock disease	92	0	0	.00	.00	61	0	0	.00	.00	173	0	0	.00	.00
Plant pests	92	0	0	.00	.00	61	-1	-1	-1.00	.00	173	-1	0	-.60	.49
Natural calamity	92	0	0	.00	.00	61	0	0	.00	.00	173	0	0	.00	.00
Income diversity	92	.25	1.00	.66	.20	61	.26	.87	.53	.14	172	.00	1.00	.53	.24

Annex 7 continued. Descriptive statistics explanatory variables per country

	Thailand					Vietnam				
Variable	**N**	**Min**	**Max**	**Mean**	**SD**	**N**	**Min**	**Max**	**Mean**	**SD**
Site	319	9	11	9.98	.81	139	12	14	13.06	.80
Data	319	0	1	.53	.50	139	0	1	.55	.50
Household size	311	1	15	4.20	1.68	137	2	10	4.24	1.24
Age head	312	24	89	48.10	11.28	139	17	70	33.93	9.56
No religion	319	0	0	.00	.00	73	0	1	.86	.34
Religion: Christian	319	0	1	.08	.26	73	0	1	.01	.11
Religion: Buddhist	319	0	1	.92	.26	73	0	1	.12	.33
Religion: Hindu	319	0	0	.00	.00	73	0	0	.00	.00
Religion: Muslim	319	0	0	.00	.00	73	0	0	.00	.00
Education head	319	1	6	2.18	1.38	139	0	3	1.35	1.04
Gender head	319	0	1	.57	.49	139	0	1	.99	.085
Status head	319	0	1	.91	.28	139	0	1	.99	.120
Farm size	313	.00	46.40	2.8671	4.46	139	.00	2.70	.4489	.35
Government supp.	319	1	1	1.00	.00	139	1	1	1.00	.00
Interest rate	319	0	0	.00	.00	139	1	1	1.00	.00
Electricity	319	-1	0	-.35	.48	139	-1	-1	-1.00	.00
Roads	319	0	0	.00	.00	139	-1	-1	-1.00	.00
Buildings	319	0	1	.35	.48	139	0	0	.00	.00
Plant disease	319	0	0	.00	.00	139	-1	-1	-1.00	.00
Livestock disease	319	0	0	.00	.00	139	-1	-1	-1.00	.00
Plant pests	319	-1	-1	-1.00	.00	139	-1	-1	-1.00	.00
Natural calamity	319	0	0	.00	.00	139	-1	-1	-1.00	.00
Income diversity	297	.25	1.00	.62	.22	139	.26	1.00	.53	.19

Annex 8. People participating in intercrop activity and people trained by gender

Country	**People participating in intercrop activity**					**People trained***				
	Male		**Female**		**Total No.**	**Male**		**Female**		**Total No.**
	No.	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
China	18	62%	11	38%	29	59	57%	45	43%	104
Ghana	14	61%	9	39%	23	13	65%	7	35%	20
India	26	27%	71	73%	97	147	33%	293	67%	440
Indonesia	70	97%	2	3%	72	70	97%	2	3%	72
Malaysia	30	39%	47	61%	77	0	-	0	-	0
Mexico	11	69%	5	31%	16	24	100%	0	0%	24
Philippines	72	52%	66	48%	138	139	53%	124	47%	263
Tanzania	20	51%	19	49%	39	31	54%	26	46%	57
Thailand	48	38%	77	62%	125	35	40%	52	60%	87
Vietnam	182	47%	202	53%	384	152	51%	148	49%	300
Total	**491**	**49%**	**509**	**51%**	**1000**	**670**	**49%**	**697**	**51%**	**1367**

Note: *The number indicates total number trained, some individuals have been trained more than once, thus the total number of people trained can be higher than the total number participating.

Annex 9. Probit (IMR) – dependent variable data

Explanatory variable	All			Ghana			India			Malaysia		
	Coef	S.E.	Sign.	Coef	S.E.	Sign.	Coef	S.E.	Sign.	Coef	S.E.	Sign.
Site	.062	.022	***									
Household size				.162	.106		-.077	.080		.111	.091	
Education head				-.406	.248					-.116	.228	
Gender head	.249	.134	*	-.876	.905					-.693	.518	
Religion: none	2.731	.606	***									
Status head				-.492	.988							
Farm size				-1.114	.387	***	-.874	1.033		.051	.079	
Buildings	-.219	.094	**									
Herfindahl index	-2.602	.331	***	-9.541	2.340	***	-4.959	.794	***			
Constant	1.064	.245	***	7.228	2.044	***	3.597	.695	***	-1.109	.779	
N		1070			78			300			92	
Chi-square		152.864	***		46.873			46.056	***		4.330	
Nagelkerke R square		.178			.602			.190			.063	
Explanatory variables	**Mexico**			**Philippines**			**Thailand**			**Vietnam**		
	Coef.	**t-ratio**	**Sign.**	**Coef.**	**t-ratio**	**Sign.**	**Coef.**	**t-ratio**	**Sign.**	**Coef.**	**t-ratio**	**Sign.**
Site							,213	,164		.296	.259	
Household size										.214	.162	
Education head	-.081	.288		.210	.129		-,183	,095	*	.779	.199	***
Gender head	.123	.635					,426	,255	*			
Status head	.394	.753		-.225	.470		-1,399	,579	**			
Farmsize							,043	,033		-.382	.560	
Herfindahl index	-.863	2.049		-1.428	.802	*	-1,951	,573	***	1.217	1.035	
Constant	.136	1.365		.428	.687		,647	1,731		-6.077	3.622	*
N		61			158			293			137	
Chi-square		1.040			7.539	*		31.220	***		20.836	***
Nagelkerke R square		0.23			.062			.135			.189	

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Annex 10. Probit (IMR) by community

Explanatory variables	Probit Pathiyoor			Probit Khog wauw			Probit Duc My		
	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig	Coefficient	S.E.	Sig
Project									
HH size				.348	.148	**			
Education head							.869	.384	**
Gender				.950	.512	*	-21.597	40193.162	
Status head				2.240	1.412		-20.873	26982.453	
Farm size	-4.569	1.654	***	.116	.139		-1.980	1.260	
Herfindahl index	-7.997	1.660	***	-3.020	1.171	**	.596	2.487	
Constant	5.605	1.202	***	-5.676	3.237	*	84.657	96820.407	
N	100			94			48		
Chi-square	33.085		***	21.828		***	12.487		**
Nagelk. R-square	.376			.276			.307		

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Annex 11. Livestock adopted and number of participants by country

Country	Nr of participants	Livestock introduced	Micro-credit	Comments
China	30	Chicken	5% annual interest, payable in 3 years	
Ghana	15	Pig		
	7	Chicken		
	13	Sheep		
India				
Pathiyoor	18	Cow	US$910	Problems with disease. Micro-credit not sufficient for good quality breeds. High costs of concentrate feed
		Chicken		
		Fishery		
		Rabbit		
Thodiyoor	60	Goat	US$1335	Most interest in goats (90%) as income generating option. High costs of concentrate feed.
		Cow		
		Duck		
		Chicken		
Devikulangara	32	Goat	US$1300	Micro-credit not sufficient for good quality breeds. High costs of concentrate feed
		Fishery		
		Duck		
		Chicken		
	5	Cow	individual bank loan	
Indonesia				
Sei Ara	11	Chicken	33,000,000Rp. already fully repaid	
Sindangjaya	37	Sheep		
	4	Chicken		Avian flu, chicken culled
Malaysia	10	Honey bee	hives	Unavailability of ready-made bee

Country	Nr of participants	Livestock introduced	Micro-credit	Comments
				hives, time needed to construct 200 hives and gelodods.
	30	Chicken		Chicken coops needed to be reconstructed or repaired which required more funds
Mexico	6	Chicken		Avian flu, 25% of chicken killed, 15% of turkeys
	3	Turkey		
Philippines				
San Miguel	13	Swine	25,000 PhP	swine breeding more profitable than swine fattening
	8	Chicken		Respiratory disease, many killed
San Isidro	3	Buffalo		
	33	Pig	89,138 PhP	
		Chicken		
Tungkalan	35	Pig	33,540 PhP	Local government also provided 50,000 PhP
		Goat		
		Chicken		
Tanzania	24	Goat		2 of 10 does died because of mismanagement, farmers were fined
	19	Chicken		New Castle Disease
Thailand				
Khog Wauw	14	Catfish	90,000 Baht	
	24	Chicken		
	1	Pig		
	1	Duck		
	16	Cow		
	1	other fish		
Saeng Arun	23	Chicken		
	43	Cow		Promotion of beef and cow-milk by province so good market opportunities
Thungka	30	Cow	200,000 Baht	
	20	Chicken		
	6	Pig		
	4	Duck		
Vietnam				
Binh Khanh	20	Goat		
		Cow		
	21	Pig		Foot and mouth disease
		Duck		
		Chicken		Avian flu
		Fishery		
Chau Binh	36	Pig		
	20	Honey bee		
	15	Cow		
	20	Chicken		Avian flu

Country	Nr of participants	Livestock introduced	Micro-credit	Comments
	almost all	Fish		
Duc My		Duck		Starting after Avian flu and foot and mouth disease
		Cow		
		Chicken		
		Fishery		
Total	**731**	**-**	**-**	**-**

Source: Country annual reports

Annex 12. OLS with IMR and dependent variable livestock income by community

Annex 13. Number of people trained on nursery management and HVPs by country

	Nursery management					High value products				
	Male		Female		Total	Male		Female		Total
Country	**No.**	**%**	**No.**	**%**	**No.**	**No.**	**%**	**No.**	**%**	**No.**
China	59	57%	45	43%	104	29	41%	42	59%	71
Ghana	5	100%	0	0%	5	11	29%	27	71%	38
India	55	49%	58	51%	113	56	10%	482	90%	538
Indonesia	68	99%	1	1%	69	75	64%	42	36%	117
Malaysia	0	-	0	-	0	152	56%	118	44%	270
Mexico	8	50%	8	50%	16	23	27%	62	73%	85
Philippines	84	54%	73	46%	157	158	42%	215	58%	373
Tanzania	63	66%	32	34%	95	111	53%	97	47%	208
Thailand	32	39%	50	61%	82	88	34%	172	66%	260
Vietnam	178	59%	122	41%	300	97	40%	148	60%	245
Total	**552**	**59%**	**389**	**41%**	**941**	**800**	**36%**	**1405**	**64%**	**2205**

Source: Country annual reports

Annex 14. Overview of comparison of means of coconut production variables

	Land area coconut							Total number of coconut trees							Total number of coconut varieties						
	Baseline			Post-project				Baseline			Post-project										
	N	Mean	SD	N	Mean	SD	Sig	N	Mean	SD	N	Mean	SD	Sig	N	Mean	SD	N	Mean	SD	Sig
Ghana	41	.93	.77	41	.83	.51		31	304.84	251.30	37	242.70	229.67		27	1.11	.32	37	1.08	.28	
India	150	.08	.12	150	.08	.12		150	16.93	17.13	150	18.43	18.61		50	1.02	.77	88	1.25	.53	**
Pathiyoor	50	.09	.14	50	.10	.15		50	16.40	20.13	50	17.40	20.33		30	.90	.92	27	1.37	.74	**
Devikulangara	50	.09	.14	50	.09	.14		50	19.02	17.69	50	21.92	21.05		10	1.10	.32	31	1.26	.45	
Thodiyoor	50	.07	.08	50	.07	.08		50	15.36	12.92	50	15.96	13.29		10	1.30	.48	30	1.13	.35	
Malaysia	57	1.88	1.70	35	1.95	1.16		53	247.77	189.58	35	218.17	151.34		53	1.00	.00	35	1.11	.40	
Mexico	32	4.99	2.59	29	4.54	2.29		32	620.16	326.81	29	594.07	312.35		32	1.53	.51	29	1.52	.51	
Philippines	63	1.59	.91	0	.	.		78	163.58	247.03	80	1901.4	2842.99	***	79	1.16	.59	64	1.58	.66	***
San Miguel	21	2.07	.62	0	.	.		28	137.14	107.82	33	4364.55	3045.21	***	28	1.25	.80	17	1.24	.44	
Tunkalan	42	1.35	.95	0	.	.		50	178.38	298.11	47	171.96	146.55		51	1.12	.43	47	1.70	.69	***
Thailand	148	1.49	3.31	169	2.17	4.79		146	211.00	446.50	154	302.99	672.18		148	.87	.44	166	1.36	.82	***
Khog Wauw	54	.11	.26	52	.10	.24		54	10.85	11.63	47	11.09	20.04		54	.78	.50	51	1.18	1.20	**
Saeng Arun	53	1.32	1.40	60	1.82	1.73	*	51	171.47	200.52	55	267.64	301.01	*	51	.86	.40	58	1.41	.62	***
Thungka	41	3.51	5.56	57	4.44	7.50		41	523.78	718.27	52	604.23	1042.49		43	1.00	.38	57	1.46	.50	***
Vietnam	61	.33	.22	61	.28	.22		61	54.30	37.18	65	41.57	38.25	*	63	1.41	.50	76	1.01	.60	***
Binh Khanh Tay	21	.19	.17	19	.18	.13		21	29.43	26.72	19	32.05	19.80		21	1.43	.51	19	1.32	.58	
Chau Binh	21	.42	.15	19	.32	.24		21	72.95	25.65	20	54.20	43.88		21	1.52	.51	30	.77	.57	***
Duc My	19	.38	.26	23	.32	.26		19	62.16	43.66	26	38.81	42.37	*	21	1.29	.46	27	1.07	.55	
All	552	1.19	2.26	485	1.30	3.15		551	166.68	309.69	550	432.88	1299.99	***	452	1.09	.54	495	1.28	.67	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Annex 14 continued. Overview of comparison of means of coconut production variables

	Number of trees per hectare							Number of varieties per hectare						
	Baseline			Post-project				Baseline			Post-project			
	N	Mean	SD	N	Mean	SD	Sig	N	Mean	SD	N	Mean	SD	Sig
Ghana	29	277.79	198.95	34	248.24	236.79		27	1.14	.57	34	1.26	.39	
India	150	419.94	649.65	150	449.83	732.32		50	28.16	41.67	88	36.17	47.84	
Pathiyoor	50	237.67	203.55	50	227.08	148.73		30	17.16	25.94	27	25.37	25.35	
Devikulangara	50	670.54	983.66	50	763.99	1130.80		10	46.82	38.52	31	53.75	69.42	
Thodiyoor	50	351.61	414.26	50	358.42	412.39		10	42.50	69.16	30	27.72	28.86	
Malaysia	49	128.03	53.65	33	118.10	44.61		49	.99	1.12	33	.87	.87	
Mexico	32	124.37	18.56	29	131.50	29.03		32	.41	.28	29	.44	.29	
Philippines	71	108.83	163.85	0	.	.		70	1.05	.92	0	.	.	
San Miguel	27	67.85	48.20	0	.	.		26	.64	.47	0	.	.	
Tunkalan	44	133.98	201.49	0	.	.		44	1.30	1.03	0	.	.	
Thailand	91	156.87	232.67	115	138.32	125.12		91	1.28	1.44	119	2.22	3.82	**
Khog Wauw	11	24.57	21.20	11	69.05	56.09	**	11	2.32	2.14	11	7.40	5.34	**
Saeng Arun	43	148.11	183.81	52	146.44	81.28		43	1.13	.86	55	1.48	2.02	
Thungka	37	206.39	296.37	52	144.85	163.16		37	1.13	1.62	53	1.91	4.13	
Vietnam	61	162.66	20.03	61	163.93	70.96		61	7.21	8.07	71	6.33	7.42	
Binh Khanh Tay	21	154.56	12.54	18	175.36	67.48		21	12.42	11.86	18	8.26	4.67	
Chau Binh	21	175.85	24.85	19	177.10	37.92		21	3.96	1.46	28	3.93	4.68	
Duc My	19	157.02	13.04	24	144.92	89.56		19	5.04	3.04	25	7.62	10.45	
All	483	234.42	405.00	426	257.12	467.83		380	5.61	17.83	375	10.61	27.42	***

Note: *Significant at the 0.10 level, **Significant at the 0.05 level, ***Significant at the 0.01 level.

Annex 15. List of project publications

PROJECT
Website
1. Cogent website - http://www.cogentnetwork.org/index.php?page=projectaccess
2. Google Coconut Group COGENT Page: http://groups.google.com/group/coconut/web/cogent

Newsletter: COGENT Updates
3. George M. L. Malaysia: A Little Investment Goes A Long Way. http://coconut.googlegroups.com/web/COGENTUpdate2007-1.jpg. 15 March 2007
4. Wilaiwan T.P., N. Peyanoot and George M. L. Thailand: A Good Life from Coconut. http://groups.google.com/group/coconut/web/poverty-reduction?hl=en. 23 April 2007
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IN-COUNTRY
Scientific Article
Mexico
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Ghana

11. Osei-Bonsu A. 2007. Multipurpose Uses and Competitiveness of Coconut. Ghana @ 50: Ghana Academy of Arts and Science Exhibition. 18-28 October 2007. Accra, Ghana.

Mexico

12. Castillo G. R. A., Domínguez C. E and Ruiz B. P. 2007. Virgin Coconut Oil Alternative to Increase Incomes of Coconut Smallholders. National Meeting of Research and Transfer Technology. (Spanish).Guadalajara, Mexico.

Philippines

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14. Life Cycle of Rhinoceros Beetle (Oryctes rhinoceros L.). 2007. Produced by: Philippine Coconut Authority, Common Fund for Commodities, Department for International Development, Asian and Pacific Coconut Community, and Food and Agricultural Organization.
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16. War against Brontispa (*Brontispa longissima*). 2007. Produced by: Philippine Coconut Authority.
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21. Lin H. D and Xing G. Y. 2007. Pepper Planting Technique. Chinese Academy of Tropical Agricultural Sciences (CATAS).
22. Zhou C. Y. 2007. Banana Planting Technique. Chinese Academy of Tropical Agricultural Sciences (CATAS).
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83. Visit of COGENT Coordinator to IFAD Poverty Reduction Project Sites. 12 and 14 May 2007.
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Malaysia

85. Interview with the project leader, community coordinator and the secretary of the Matunggong Coconut Grower Organisation by Radio Television Malaysia, 30 Aug, 13, 20, and 27 Sep 2007.

Philippines

86. Coconut Farmers Need Not Be Poor. Press release broadcasted at 91.7 DYGB FM station at 8:00am on May 25, 2007 in Dumaguete City

Vietnam

87. Seedlings Standards and Methods of Quality Seedling Selection after the Hurricane. In collaboration with Dong Go Experimental Center. Broadcasted in the news at 7.30pm in Ben Tre Television on May 2007.

Training manuals:

- establishing and managing community based organizations;
- establishing and managing a sustainable village-level microcredit system;
- characterizing and conserving farmers' coconut varieties;
- evaluation and operation of inexpensive village-level machinery for oil milling;
- production and marketing of high-value products from the coconut kernel, husk, shell, water, wood and leaves;
- coconut-based intercropping of cash and food security crops;
- livestock and fodder production;
- profitability analysis of income generating technologies;
- coconut data analysis.

Annex 16. Collaborating organizations

Country	Main implementing partners	Other partners	Nature of linkage
China	Coconut Research Institute (CRICATAS)	Tropical Crops Germplasm Research Institute of CATAS	Research support
		Wenchang Science and Technology Bureau	Research support
		Hainan Forest Authority	Research support
Ghana	Oil Palm Research Institute (OPRI)	Nzema East District Assembly	Advice on CBO establishment
		Animal Research Institute	Livestock research support
		Crops Research Institute	Planting materials
		PEEWOOD Craft and Art Cottage	Handicraft production skills
India	Central Plantation Crops Research Institute (CPCRI)	Kerala Agricultural University	Quality planting materials
		Vayalar Coconut Community	Resource person
		Local media (Mathrubhumi, Malayala Manorama Daily, Kerala Kaumudi, Chandrika Daily, Thejus Daily, Desabhimani Daily)	Public awareness
		All India Radio	Public awareness
		Banks (such as Canara Bank, Kayamkulam and Primary Agri. Development Bank, Alappuzha)	Additional funding support
		Kerala State Department of Animal Husbandry	Livestock research support
		Krishi Bhavan (Kerala State Dep. of Agriculture)	Resource inventory
		Krishi Vigyan Kendra	Quality planting materials
		Vegetable and Fruit Promotion Council of Kerala	Quality planting materials
		Central Tuber Crops Research Institute	Quality planting materials
		Kerala State Dairy Development Department	Livestock research support
Indonesia	Indonesian Center for Estate Crops Research and Development	Batik and Handicraft in Yogjakarta	Handicraft production skills
Jamaica	Coconut Industry Board (CIB)	International Coconut Genebank in Cote d'Ivoire	Quality coconut seedlings
Malaysia	Department of Agriculture (DOA)	Federal Agriculture Marketing Authority	Training and marketing HVP
		Veterinary and Animal Husbandry Department	Livestock research support
		Rural Development Corporation	Technical support on bee keeping
Mexico	Instituto de Investigaciones Forestales, Agricolas y Pecuarias	Tabasco AC Foundation	Sharing experiences
		Tabasco State Advice of Science & Technology	Interest to fund a new project
Philippines	Philippine Coconut Authority (PCA)	Provincial government of Oriental Negros	Quality seedlings
		Department of Agriculture	Corn seeds

		Cocoa Foundation of the Philippines (COCOAPHIL)	Training on cocoa intercropping
		Albay Packaging Center	Packaging and labelling technique
		East-West Seed Company	Vegetable production
Tanzania	Ministry of Agriculture and Food Security (MAFS)	Ministry of Agriculture	Quality planting materials
		Labour, Employment and Youth Development	Technical advice
		Bagamoyo District Council	Community establishment
		Small Industries Development Organization	Trainings and resource person
		Centre for Counselling, Nutrition & Health Care	Technical advice
		Bagamoyo's District Office	Community establishment
Thailand	Horticulture Research Institute (HRI)	Chaiburi Village Administration	Technical advice
		Chumphon Agricultural Extension Office	Research support
		Chumphon Community Development Office	Community establishment
		Thungka Sub District Administration Office	Community establishment
		Fertilizer Sub District Programme	Technical advice
		Office of Provincial Livestock Development	Livestock research support
		Phattalung Community Development Office	Community establishment
		Seang Arun Sub district Administration Office	Community establishment
		Phattalung Agricultural Extension Office	Planting materials
Vietnam	Oil Plant Institute (OPI)	Thuan Hiep cooperative, Ben Tre province)	Technical advice for HVP
		Tra Bac company, Tra Vinh province	Technical advice for HVP
		Phu Hung, Ben Tre province	Technical advice for HVP
		Viet Kor company, Ben Tre province	Technical advice for HVP
		United States Department of Agriculture	Training support
		Ben Tre provincial government	Coconut development area
		International Labor Organization	Technical advice

Source: project report 2007 and partner questionnaire