

Diversification for Livelihood Security: Experiences from Major Coconut Growing Countries*

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Abstract

This paper presents the success of community based organizations in achieving sustainability in marginal coconut holdings through diversification of crops and enterprises along with conservation of local varieties. The project was implemented in 19 communities of 10 coconut growing countries and findings from four major coconut growing countries, which had significant project outcome - India, Philippines, Thailand and Vietnam - are discussed in the present paper. All the four major coconut growing countries recorded a significant difference in total household income over the project period. Among the four countries, India and Philippines had a significant difference in mean income derived from intercrops, India and Thailand for livestock integration and India and Vietnam for off-farm activities. Herfindahl index for indicating economic diversity of households revealed a significant diversification of income for India as well as the overall data for the four countries. A higher level of education and more available land also positively influenced total income. In general, improvements in income were better with bigger-sized farms and households, with male household heads. The overall data revealed significant improvement in food and nutritional security with clearest impacts in India and Philippines due to project efforts. Participation of women in trainings and interventions was the highest in India, followed by Thailand.

Keywords: Diversification, Livelihood security, Community-based organizations, Income, Food nutritional security.

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Introduction

The current scenario of coconut cultivation in most of the growing countries is challenging mainly because of the higher cost of cultivation stemming up from high labour charges. Majority of the operations including harvesting are highly skill oriented and currently face chronic shortage with all institutional efforts. Under such conditions, marginal coconut growers from several coconut growing countries are striving hard to sustain their families' livelihoods from coconut-derived income alone. As the income from coconut alone is not sufficient for meeting total requirements of a family, a mix of interventions involving diversification of crops and allied enterprises is required for improving the income as well as the food and nutritional security of households. While there is tremendous potential for tapping the under-utilized community labour force, including women, to generate income from high-value coconut products, the mechanism for promoting these and other income-generating technologies are not effectively in place at the village level. Moreover, there are several technical, institutional and market constraints that hinder the effective utilization of research results to benefit the poor. Therefore, a concerted effort was taken to develop income-generating models in strategically selected coconut-growing communities through a project network entitled 'Overcoming Poverty in Coconut-Growing Communities: Coconut Genetic Resources for Sustainable Livelihoods, supported by IFAD / COGENT/ Bioversity International. The major interventions of this project were to introduce cash and food security intercrops, livestock and/or fodder production, production and marketing of high-value products from all parts of the coconut and to establish community-managed coconut seedling nurseries.

Materials and Methods

The project was implemented in 19 communities of 10 coconut growing countries: China, Ghana, India, Indonesia, Philippines, Mexico, Malaysia, Vietnam, Tanzania and Thailand. National level implementing

organizations included national research institutes and governmental bodies. In many of the implementing countries logistical support was provided by the local governments through provision of low interest rate credit or planting materials like vegetable seeds. The interventions aimed to increase income derived from a coconut-based farming system and to improve food security and nutrition. Livestock and intercrop interventions, diversification of coconut products and conservation of coconut genetic resources were implemented on a community basis. Each community selected the most suitable intercrops, both cash and food crops, and livestock for the agronomic and market conditions in the project sites. The project assisted in the selection of crops and livestock, provision of planting materials, animals and shelter if necessary, plus training on management of crops and livestock. The activities were carried out through registered Community Based Organizations (CBOs) based on the annual action plans prepared by the members. Major thrust was given for training/capacity building for the CBO members in developing their individual as well as group capacities in terms of technological interventions, arrangement of inputs and management of CBOs.

With the participation of CBO members, the most suitable intercrops including both cash and food crops were selected for each community, considering the capacity of the households and specific local agronomic, socio-cultural and market conditions. The project assisted in the provision of high quality planting materials and inputs through a micro-credit scheme. A total amount of US\$ 10,000 was disbursed to these communities as micro-credit, which was utilized mainly for intercropping including nutrition gardening, nursery establishment, livestock rearing, production of high value products, and for mushroom production and azolla cultivation in India, for instant.

Effective recycling of coconut and other crop and animal wastes through vermi-composting was implemented in some communities of India to improve production and

reduce waste. Assistance was provided for sourcing machineries and equipments for processing. As part of conservation of genetic resources in coconut, awareness was created on the importance of conserving their native varieties, organized diversity fairs and established community nurseries in all the communities.

Findings from four major coconut growing countries, which had significant project outcome - India, Philippines, Thailand and Vietnam - are discussed in the present paper. Pre and post data related to demographic, socio-economic as well as food security and nutrition aspects of the clients and income from coconut, intercrops, livestock and household level processing were recorded independently in each country, using a standardized questionnaire template during 2005-06 and 2007-08. Data collection was done through personal interview with around 450 CBO members from four countries and supplementary data was recorded from the profitability records kept by them. The data was coded and analysed through SPSS by adopting statistical tools like frequency, average, percentage analysis, t - test and regression.

Results and Discussion

Capacity development

The capacity development efforts concentrated not only on the technological trainings but a number of programmes related to CBO management, micro-credit management, public dealings and personality development. Large number of trainings after assessing the training needs was imparted on various aspects of intercropping, livestock production and preparation of high value products in all participating countries (Table 1).

Total number of 3,169 participants of four countries were trained on various aspects related to intercropping, livestock production and preparation of high value products, of which 72% were women participants. The highest total participation as well as women participation was recorded for production of high value products, followed by intercropping. Among the four countries, the highest participation in training

was in India, followed by Philippines. The participation of women in trainings was highest in India with 90% female involvement in high value products training followed by Thailand. As the production of high value products was done at household level, higher participation of women in trainings resulted in higher level of adoption of off-farm activities.

Adoption of Interventions

Capacity building programmes resulted in increased rate of adoption of various interventions, specifically the production of high value products, which was quite new to many of the members. However, apart from the farmers who underwent trainings, other farmers also utilized the micro-credit for expansion of existing activities, mainly the livestock integration as revealed through Table 2.

Of the 3,169 participants of four countries trained, 2,147 persons utilized the micro credit facility for adoption of various interventions. Livestock integration recorded the highest adoption through micro-credit utilization, followed by intercropping and the lowest in the case of high value products. It was interesting to note that the involvement of women (by average) was more in adoption of various interventions like intercropping (56%), livestock integration (57%) and high value products production (65%) by utilizing micro-credit, when compared to men. As in the case of capacity building, female participation was the highest in India for all the interventions. Even though the farmers were found to adopt different interventions during the pre-project period to some extent, more intensive and scientific adoption could be achieved through the utilization of micro-credits together with training outputs. The provision of micro-credit has been found to strengthen crisis-coping mechanisms, diversify income-earning sources, build assets and improve the status of women (Hashemi *et al.*, 1996).

The need to link training with micro-credit is very much crucial in utilizing the acquired skills as highlighted by Sermoneta (2003) while strongly emphasizing the provision of financial services to the poor. Strengthening the

capabilities of the poor through skills-enhancement with importance for the involvement of women was also highlighted as an important factor in poverty reduction. Micro-credit had the greatest effect on control over assets by women and also on their knowledge of social issues (Zaman, 1999).

Improvement in total income

Total income is composed of income derived from coconut, intercrops, livestock, other on-farm activities, off-farm and non-farm sources of income. The mean of the total income derived from all sources together was calculated before and after the project and is provided in Table 3.

The data revealed significant improvement in total income over the project period in all the four countries, with the highest improvement in Thailand, followed by India. The major reasons can be attributed to the diverse interventions introduced coupled with the synergetic effect of community participation and nutrition education as observed elsewhere in a Discussion Paper on the Effectiveness of Sustainable Agriculture Projects (Dominique *et al.*, 2002) in the NGO Food Security Program Effectiveness Group. The yields of selected crops and the number of livestock kept under homestead farms contributed remarkably to food security and farm income in southeastern Nigeria in terms of output and provision of varieties of crops relative to distant farms (Ndaeyo, 2007). Because of the synergies between crop and livestock components, mixed crop-livestock systems have shown themselves to be both economically and environmentally robust from a smallholder perspective (Kenneth *et al.*, 2005).

Because the income generated have had most influence on intercrop, livestock and off-farm activities, we examine the mean income level before and after the project derived from these income categories and their correlation with total income in Tables 4, 5 and 6.

Improvement in income from intercrops

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. 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. 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. Income derived from intercrops was recorded before and after the project and is presented in Table 4.

At national level, Philippines and India had a significant difference in mean income derived from intercrops before and after the project. In these countries, the project had good linkage with providers of good planting materials. Further, the project efforts in identifying suitable intercrops like vegetables, banana, corn and tubers paved the way to success. The mean difference of the total sample was also significant and positive.

Improvement in income from livestock

Livestock integration was intended mainly for augmenting household income and improving nutritional security. Evidence from in-depth field studies in Asia and Africa indicates that livestock contribute as much as 76% of household incomes in some regions, and generally a higher percentage to the incomes of poorer households (Delgado *et al.*, 1999). Provision of sufficient organic manure is an added benefit of livestock integration in coconut based farming systems. Country-wise comparison of the income from livestock before and after the project period is presented in Table 5.

Even though the income from livestock was significantly associated with total income, the improvement in income from livestock after the project over the pre-project period was found to be positively significant only in case of India, whereas it was negatively associated for Thailand. This might be due to the shifting of some of the CBO members from livestock to a better off farm activity.

Improvement in off-farm income

Off-farm activities related to production and marketing of coconut-based products enabled the CBO members to generate additional income, which resulted in empowerment of small groups preferably that of women. The income from off-farm activities before and after the project were compared and presented in Table 6.

Significant change was observed in the off-farm income before and after the project period, with highest improvement in Vietnam, followed by India.

Herfindahl index for income diversification

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 (coconut, intercroops, livestock, other on-farm, off-farm and non-farm in this case). The index always takes a value between zero and one, whereby one represents complete specialization. Herfindahl indices for the pre and post project periods and the improvements in income diversification were worked out for all the four countries (Table 7).

The overall figures for the four countries showed a significant improvement in the diversification of income, except for Vietnam, which was found to be negative. In countries like Vietnam, more of specialization, specifically off-farm activities contributed for improvement in total income. Diversification was found more ideal under the homestead conditions, where the size of holdings is marginal as revealed through the highest improvement in income diversification achieved by India. Kasem and Thapa (2011) also found that the farmers with small landholdings adopted crop-diversification more than the farmers with large landholdings. Pooled data for all the four countries also showed a significant diversification of income.

Influence of the project on different income categories and food and nutritional security

Although the mean difference in income gives an indication of the change that occurred during the course of implementation of the project, it does not determine whether these changes have been caused by the project or whether external factors have caused this change. Hence, the influence of project on income was statistically worked out by second-stage regression with ordinary least square.

The food and nutritional security was measured using the following statements with the question for respondents to indicate whether in the last three months prior to the time of interview they experienced the situations 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 food 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 column of food and nutritional security shows the change in the occurrence of the four situations. The indicated numbers are derived by giving a value of +1 for a positive change, -1 for a negative change and 0 for no change for each situation and adding them for the total four situations.

Table 8 shows an overview of the regressions for the outcome indicators viz., intercrop, livestock, off-farm and total income along with change in food and nutritional security status.

The project positively influenced the total income in all the four countries. The project influence was significant for income from intercrop and off-farm income for India, intercrop for Philippines and some communities of Thailand and Vietnam. For Vietnam, the

Table 1. Intervention-wise and Gender-wise Participation in Training programmes

Country	Intercrops					Livestock					High value products				
	Male		Female		Total	Male		Female		Total	Male		Female		Total
	No.	%	No.	%		No.	%	No.	%		No.	%	No.	%	
India	147	33	293	67	440	87	41	124	59	211	56	10	482	90	538
Philippines	139	53	124	47	263	50	48	54	52	104	158	42	215	58	373
Thailand	35	40	52	60	87	15	42	21	58	36	88	34	172	66	260
Vietnam	152	51	148	49	300	177	57	135	43	312	97	40	148	60	245
Total/average	473	43	617	57	1,090	329	50	334	50	663	399	28	1017	72	1,416

Table 2. Adoption of Interventions by Utilizing Micro-credit

Country	Intercrops					Livestock					High value products				
	Male		Female		Total	Male		Female		Total	Male		Female		Total
	No.	%	No.	%		No.	%	No.	%		No.	%	No.	%	
India	26	27	71	73	97	23	20	90	80	113	5	19	21	81	26
Philippines	72	52	66	48	138	52	44	67	56	119	18	33	36	67	54
Thailand	55	40	84	60	139	49	43	66	57	115	42	30	97	70	139
Vietnam	182	47	202	53	384	225	49	235	51	460	136	37	227	63	363
Total/average	335	44	423	56	758	349	43	458	57	807	201	35	381	65	582

Table 3. Comparison of total household level income before and after the project

Country	Baseline (Pre-project)		Post-project		Significance
	No. of households (N)	Mean Income (\$)	No. of households (N)	Mean Income (\$)	
India	150	1,750	150	3,953	***
Philippines	87	2,326	84	3,887	***
Thailand	138	5,561	163	9,894	***
Vietnam	63	1,773	76	3,706	***
Total/average	438	2,853	473	5,360	***

Significance *** 0.01 level

Table 4. Comparison of pre and post income from intercrops and correlation of intercrop income with total income

Country	Baseline (Pre-project)		Post project		Significance (t-test)	Correlation with total income
	No. of house-holds (N)	Mean Income (\$)	No. of house-holds (N)	Mean Income (\$)		
India	150	61	150	255	***	0.538**
Philippines	87	65	85	917	***	0.312**
Thailand	138	45	163	55		0.136
Vietnam	63	94	76	114		0.080
All	438	66	474	335	***	0.283**

t-test significance *** 0.01 level

Correlation significance ** 0.01 level

Table 5. Comparison of pre and post income from livestock and correlation of livestock income with total income

Country	Baseline (Pre-project)		Post project		Significance (t-test)	Correlation with total income
	No. of house-holds (N)	Mean Income (\$)	No. of house-holds (N)	Mean Income (\$)		
India	150	142	150	622	**	0.737**
Philippines	87	564	85	569		0.650**
Thailand	140	717	163	438	* (-)	0.583**
Vietnam	63	250	76	387		0.346**
All	440	418	474	504		0.099**

t-test significance * 0.10 level, ** 0.05 level, Correlation significance ** 0.01 level

Table 6. Comparison of pre and post off-farm income and correlation of off-farm income with total income

Country	Baseline (Pre-project)		Post project		Significance (t-test)	Correlation
	No. of house-holds (N)	Mean Income (\$)	No. of house-holds (N)	Mean Income (\$)		
India	150	5	150	163	**	0.482**
Philippines	87	135	85	144		0.316**
Thailand	138	1,141	163	1,559		0.283**
Vietnam	63	173	76	917	**	0.300**
All	438	364	474	695	**	0.284**

t-test significance ** 0.05 level

Correlation significance ** 0.01 level

Table 7. Comparison of pre and post Herfindahl index for income diversification

Country	Baseline (Pre-project)		Post project		Significance	Improvement in income diversification (%)
	No. of households (N)	Mean Index	No. of households (N)	Mean Index		
India	150	0.70	150	0.57	***	18.57
Philippines	87	0.57	85	0.48	***	15.79
Thailand	134	0.68	163	0.58	***	14.71
Vietnam	63	0.52	76	0.53		- 1.92
All	434	0.62	474	0.54	***	12.90

Significance *** 0.01 level

Table 8. Summary of outcome indicators

Country/ Community	Significant influence of project by income category				Food and Nutritional Security
	Intercrop	Livestock	Off-farm	Total Income	
India	105.53***		71.09**	1561.71***	+4
<i>Pathiyoor</i>	151.61**		94.45*	1993.75***	+4
<i>Devikulangara</i>	145.29***			1524.88***	+4
<i>Thodiyoor</i>			136.02*	1719.80***	+4
Philippines	840.81***			835.57**	+1
<i>San Miguel</i>	1279.46***	-517.51***	-203.65***		+2
<i>Tunkalan</i>	629.41***			1108.43*	0
Thailand		-555.78***		1995.60***	-2
<i>Khog Wauw</i>	60.17**				-2
<i>Thungka</i>					-2
<i>Saeng Arun</i>		-1713.72***		3071.75*	-2
Vietnam			655.70***	1518.35***	-4
<i>Binh Khanh Tay</i>			1671.49***	1369.46***	-2
<i>Chau Binh</i>	-178.18***			1732.36***	0
<i>Duc My</i>	190.57**		613.07**	1111.05***	-2

Values are the coefficients of the second stage regressions. Coefficients significant at *0.10 level, **0.05 level, ***0.01 level.

project influence was more on off-farm income. For some communities of Philippines and Vietnam, the project negatively influenced income from livestock, intercrop or off-farm activities. This clearly revealed a shift to a better option of economic activities by the communities. Analysis of the overall impact of the project in the major coconut growing areas indicated that the project could make significant improvement in the income derived from intercrops, followed by off-farm income. The project efforts in identifying suitable intercrops like vegetables, banana and tubers and off-farm activities for each of the CBOs were the major factors in achieving the success. Very clear impact on food and nutritional security has been obtained for all the three CBOs of India and moderate improvement in one community of Philippines. All the four situations related to food and nutritional security recorded positive changes for India, indicating a completely secure condition. But in case of other countries, the impact was negative, might be due to more emphasis given for income generation rather than concentrating on the food and nutritional security of the households.

The attempts made under this project by India was successful in bringing out significant improvements in the food and nutritional security of the communities preferably through intercropping with non-cereal foods, vegetables and fruits; animal husbandry and dairy activities and off-farm activities including diversification of products from coconut and other crops. Based on several reviews on changing consumption patterns in India, Amarasinghe *et al.* (2007) also emphasized the need for diversification of future agriculture production, especially to high value non-grain crops for improving the food and nutritional security. Homestead gardens provide various food products and a substantial proportion of the nutritive and energy requirements of the local diets (Fernandez and Nair, 1986). Women members were trained on preparation of nutritious foods like squashes, snacks and baby food using locally available fruits, cereals, coconut and other materials.

Association between total income and explanatory variables

Variables like age, education, gender, farm size, area under coconut and Herfindahl index were correlated with total income to see whether such factors influence total income in any of the four countries. Table 9 provides the data related to the association between such factors and total income.

The results of the correlation showed that farm size had a significant relationship with total income in case of India, Thailand and Vietnam. Educational level of the household head was found to be positively significant for India, Philippines and Vietnam. In some communities, gender of the household head played a role, where having a female household head negatively influenced expected total household income. However, the sustainability was found to be more for those activities where women involvement was high. In general, women-headed households focus more on meeting food self-sufficiency needs using a diverse portfolio of products to meet a range of nutritional and domestic needs. Male-headed households have generally been shown to be less risk-averse and often focus on the production of cash crops. Farmer age and education level are also considered to be important factors in conditioning willingness to accept new ideas and technologies (Soule' *et al.*, 2000). Iiyama *et al.* (2007) also reported education, participation in farmers' groups, access to the training centre, and family size as the key factors affecting the adoption of Crop-Livestock Diversification patterns. In general, improvements in income were better with bigger-sized farms, with male household heads.

The major inferences that could be drawn for the project are as follows:

- A. Improvement in income from various interventions and overall income diversification**
 - Improvement in income from all interventions was achieved by India, which was also revealed through the positive and significant association between Herfindahl

Table 9. Association between total income and explanatory variables

Explanatory variable	India	Philippines	Thailand	Vietnam	All
Age	0.110	0.044	-0.009	-0.167*	0.141
Education	0.160**	0.234**	-0.041	0.262**	0.018
Gender	-0.087	0.080	-0.047	-0.058	-0.044
Farm size	0.256**	0.136	0.213*	0.366**	0.290**
Area under coconut	0.252**	0.085	0.248*	0.066	0.294**
Herfindahl index	0.469**	-0.141*	0.080	-0.014	-0.032

Correlation significance ** 0.01 level

index and total income. This might be due to selection of interventions suited to the specific requirements of the marginal homesteads and local market.

- The association of income from diverse interventions to total income was significant for almost all countries, while Vietnam showed a decrease in Herfindahl index over the project period.
- Diversification was found more ideal under the homestead conditions (India), where the size of holdings is marginal.

B. Influence of project on different income categories

- The project could improve the total income in all countries.
- Project influence was more on income from intercrops, followed by off-farm income. Livestock income was not positively significant for any of the countries.
- Negative significance of income from livestock and off-farm income denotes a shift to a more ideal intervention suited to the prevailing conditions.

C. Project influence on food and nutritional security

- The clearest positive impact of the project on food and nutritional security achieved in India coupled with a positive and significant association between Herfindahl

index and total income reveals that diversification can lead to high food and nutritional security along with income generation.

- Negative influence of the project on household level food and nutritional security in Vietnam and Thailand might be due to more dependence on off-farm activities for income generation.

D. Factors influencing total income

- Farm size, size of coconut holdings and education positively influenced total income in many communities.
- In some communities, gender of the household head plays a role, where having a female household head negatively influenced expected total household income. However, the sustainability was found to be more for those activities where women involvement was high.
- In general, improvements in income were better with bigger-sized farms, with male household heads.

Conclusion

While the income from coconut under mono cropped conditions does not hold promise in most of the coconut growing countries, diverse interventions compatible under coconut based farming systems adopted in the present model was proved as successful and replicable. Under the tested model, the communities

involved differed in their socio-cultural profile, and interventions were made compatible with local conditions. Still, some countries like India clearly had more success in income increase and food security than the others. The reasons for the country-wise differences in the project outcome need to be analyzed and further research is suggested to understand the underlying reasons to replicate the model under different socio-economic conditions and to study the costs and benefits of the interactions in the farming systems.

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Azolla Cultivation



Cluster Training Programmes



Community Level Coir Spinning



Harvest Fest by CBOs



Homestead Vegetable Cultivation



Mushroom for Nutritional Security



Training on Coconut Food Products



Training on Nutritive Foods



Training on Value Addition of Coconut



Vegetable Cultivation