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INTRODUCING PALAYAMANAN IN RAINFED ECOSYSTEMS USING THE CPAR APPROACH: A FRAMEWORK OF ANALYSIS

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ABSTRACT

Rainfed rice farmers are challenged by repeated occurrences of drought and crop failure and the literature states that crop diversification may be one possible way of building resilient agricultural communities. Cognizant of this, the Philippine Rice Research Institute (PhilRice) conceptualized and established the first *Palayamanan* project in 2010. This project introduced a diversified integrated rice-based farming system to help rice farmers enhance their income and productivity. This paper describes the framework of analysis and the study site selection process and gives an overview of the results.

Keywords: Community-based participatory action research, Palayamanan

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I. Rationale

Rainfed rice farming is a daunting challenge and a wide array of issues related to this has been identified, especially from subsistence production to production for the market. One important contemporary issue is the impact of climate change. Efforts have also been accorded to addressing the issues of availability, sufficiency, and access to various production inputs, which include both physical and social infrastructure primarily sourced from various delivery systems of the government.

Among these, extension is recognized to play a role in raising as well as sustaining farm income and agricultural growth as it serves as anchor to other production inputs, particularly the development of technical and social capabilities, communication of new information/knowledge, and advocating good/appropriate practices to farmers and farmer groups. The fragmented and weakened state of the country's agricultural extension system brought about by policy and institutional limitations, however, has undermined the potential catalytic role of extension in achieving the desired agricultural outcomes. The need for a locally driven, multi-actor governance framework extension delivery system remains central in many agricultural settings (Rola et al. 2012).

While local initiatives are currently explored, there are participatory approaches that have proven to be adaptive to local conditions. The Palayamanan technology of the Philippine Rice Research Institute (PhilRice) can be aptly disseminated through community-based participatory action research (CPAR) of DA-BAR.

The Palayamanan model of diversified integrated rice-based farming system developed and established by PhilRice is composed of synergistically compatible farming ventures (Corales et al. 2004). PhilRice coined the word to encourage farmers to increase not only their rice yield but also their income. The term *palayamanan* is made up of two simple words: "palay," the Filipino term for rice at any stage prior to husking, and "*yaman*," a term meaning wealth. The combined words mean that there is wealth not only in rice, but that rice can be combined with other high-value crops, livestock, and fish to generate more wealth. Rice is the major component of the system as it is the staple food of the Filipinos. Adding high-value vegetable crops, fishponds, poultry, and livestock increases the income of farming households and ensures a continuous supply of food for the family.

Palayamanan employs practical, cost-saving, and yield- enhancing management practices (Corales et al. 2004). The system aims to maximize resource utilization; reduce farming risks; enhance sustainability, productivity, and profitability; and improve economic stability food security, and, hopefully, foster a better relationship among members of the farm family. A 1-hectare diversified farm can sustain most of the daily food requirements, incidental expenses from fast-growing crops, and provide considerable income from animals, fish, and seasonal field crops.

The CPAR framework was used to engage stakeholders throughout the research-extension process – from selection of study sites, identification of problems in the community, development of data collection tools to analysis of results and dissemination of findings. The Palayamanan system of farming, on the other hand, was promoted as a more effective way to utilize natural resources and improve farmers' income.

CPAR is one of two banner programs of BAR under DA. It is a location-specific research cum extension activity that uses CPAR. This approach aims to modernize agriculture and fishery industries through effective management of community resources.

It differs from the traditional technology adaptation and verification method that most research institutions adopt. CPAR verifies the technical and economic feasibility of emerging and mature technologies in specific locations before its widespread adaptation. Through CPAR, the community is enjoined to actively participate and be sensitized on the value of information-based decision making. The community is empowered by organizing their production management systems. The participatory nature of CPAR is intended to give attention to a holistic orientation to the overall management of production. These include farming systems development; resource management orientation; and community-based, whole farm. and family systems approach, complementation, and integration (DA BAR nd). These processes are showcased in a model framework focused on a community-based resource management system.

CPAR diversifies livelihood options for farmers and fishers, enabling them to use technology to improve production and gain profit. As such, CPAR promotes the agribusiness development approach in the regions particularly in terms of enhancing and cultivating productive and sustainable agriculture and fisheries on a more local level.

II. Review of related literature

2.1 Integrated farming system as a poverty reduction strategy

The concepts associated with integrated farming system (IFS) are accepted and practiced by numerous farmers throughout the globe. Commonly, IFS is characterized by a combination of crop and livestock enterprises and, in some cases, may include combinations of aquaculture and trees (Noble 2009). IFS, a multidisciplinary whole-farm approach, is very effective in solving the problems of small and marginal farmers, increasing income and employment by integrating various farm enterprises and recycling crop residues and crop byproducts within the farm itself (Soni, Katoch, and Ladohia) (2014). Reviewing several articles on IFS, Noble (2009) noted that cash crop and staple crop production and continuous production with external inputs reduce the ability of the soil resource base to both provide and retain nutrients, which often results in a decline in productivity. Moreover, reliance on a few crops with a high risk of crop failure due to diseases and climate change (Reijntjesm et al. 1992 as cited in Noble 2009) exposes farmers to low productivity and income. Hence, IFS are often viewed as a sustainable alternative to commercial farming systems particularly on marginal land with the objective of reversing resource degradation and stabilizing farm income (Noble 2009). Lightfoot and Minnick (1991 as cited in Noble 2009) reported that use of diverse plants and

animals broadens possible sources of income, provides inputs to other enterprises, and constitutes a source of meat and milk and a means of savings.

The implementation of IFS in several countries resulted in increased productivity and assured period income (Manjunatha et al. 2014). The rice-brinjal crop rotation is the best in terms of productivity and profitability, owing to the higher yield of brinjal (Korikanthimath and Manjunath 2009 as cited in Manjunatha et al. 2014) in a research complex in Goa, India. The system yielded a total of 11.22 t of rice grain per hectare. Further, with the integration of mushroom and poultry production (based on resource availability within the system), productivity increased to 21, 487 kg/ha, especially with the rice-brinjal rotation. The system approach was found to be sustainable as reflected by changes in soil organic carbon and as indicated by the sustainability yield index.

In the Philippines, Parreño-de Guzman, Zamora, and Bernardo (2015) reviewed several examples of diversified farming systems that cater to different topographic landscapes of the country. For the lowland, the paper presented the coconut-based multi-storey system, organic farming, and bio-intensive gardening; for the upland, it described sloping agriculture land technology, vegetable agroforestry, and upland food production systems of indigenous people. These farming systems mostly focused on resource-poor farmers; they aimed not only to improve their livelihood and nutrition but also to conserve dwindling resources as well as protect the fragile environment in which they live. The authors stressed that the crop production components can give considerable income, much higher than that obtained from rice production alone, despite some difficulties such as damaged crops, less production due to bad weather, pests, and low prices.

Hartmann, Jahnke and Peters (2006) saw great potential for small-scale farmers to get out of the poverty trap through diversification in the form of integrated agriculture-aquaculture. A cash-flow analysis of rice-duck farming (based on specific conditions in a farmer's field) indicated a 30% increase in farm benefit compared with rice farming alone (USD310/year vs USD 437/year). Moreover, ducks were used to eliminate the snail population as the rice field was being plowed.

In spite of continuing efforts to alleviate poverty among small farmers through various production systems, marginal farmers constitute one of the poorest sectors of the country. The need for a more participatory approach to characterize farming resources and farming needs of farmers warranted a search for other strategies to assist them. Hence, the Palayamanan Program of PhilRice and the CPA R of DA BAR were introduced.

2.2 The Palayamanan Program of the Philippine Rice Research Institute

CRDES has exemplified the value of forging partnerships toward achieving food security. These partnerships involved national to local institutional linkages through which national to local delivery is done under the FIELDS program; research and development partnership between state universities and colleges (SUCs) and local government units (LGUs) on certified seeds and other technology demonstration in selected sites; and regional

collaboration in provincial rice action planning and regional research proposal making. UPLB also conducted capacity-building activities with various partners toward better understanding and management of food security at the provincial and regional levels. Partnering with local farmer groups for seed security was also facilitated (Rola et al.2012).

The Palayamanan technology can strengthen partnership for food security and eventually improve the productivity and income of farmers. According to Obien et al. (2011), Palayamanan is a modification of the *bahay kubo* concept of integrating different farming activities to address food insecurity, malnutrition, and extreme poverty, especially in fragile environments. It is defined as a diversified integrated rice-based farming system, with rice as the base crop, combined with other farming ventures in a synergistic manner, implemented by the family based on available resources and existing environments to attain family goals and aspirations. Palayamanan has the "be rich" principles of better resource allocation; enhanced biodiversity and ecological balance; reduced production risks; increased cropping intensity, productivity, and sustainability; continuous food supply; and higher income, profit, and economic stability.

PhilRice operationalized the Palayamanan concept in a diversified integrated rice-based farming system called "village model" (Corales et al. 2004). This village model is a farming system with rice as the base crop; it is integrated with other crops, aquaculture, livestock, pomology, biomass recovery system, and other farming ventures. Palayamanan combines indigenous knowledge with research-generated technologies and farming systems adaptable to local conditions to increase productivity and profitability and enhance the sustainability of the farm.

Under Palayamanan, PhilRice provides assistance to SUCs, PhilRice branch stations, LGUs, attached agencies of the DA, and non-government organizations (NGOs), including cash for travel and other incidental expenses of partners' personnel; loans to farmers; and farm inputs, planting materials, or livestock live animals, whereas the implementing partners provide counterpart funds in the form of manpower through involvement of agricultural technicians (Corales et al. .2004). Farmers, on the other hand, shoulder the construction of the Dap-ayan (multipurpose shed) as their contribution to the project. Other schemes included the financial assistance of Bulacan Agricultural State College and Pampanga Agricultural College to the Palayamanan farmer beneficiaries (CHED loan assistance to SUCs), and the capital roll-over scheme of funds or the livestock dispersal program of the Palayamanan. It further induced farm diversity by integrating other farm ventures, including vegetables, livestock, and poultry; promoting the use of quality rice seeds; reducing the rice seeding rate of farmers; and encouraging the use of better nutrient, weed, pest, and water management techniques. One of the major impacts of the program was the improvement of farm profitability among project beneficiaries. Across different provinces and Palayamanan sites, the farm-level profit ratio of a Palayamanan system to a monocrop rice system was generally greater than unity.

2.3 Integrated Farming Practices

Practices similar to Palayamanan can also be found in other countries. Cultivation of legumes and indigenous vegetables as an extension of the rice-based system is an example. Grain legumes or pulses are significant in terms of nutrition and subsistence farming. It is vital in enhancing soil fertility through symbiotic nitrogen fixation. Pulses supply the main part of the dietary protein (20-25% protein by weight, which is two to three times that of wheat and rice) of the less fortunate who cannot afford meat and other vegetables. Its residues and byproducts can be used as fodder, feed, and firewood. In 2009, legume (excluding soybean) exports and imports were valued at USD 75,459,000 and USD 29,184,000, respectively (FAO 2011 as cited in Shrestha et al. 2011). In Nepal, grain legumes are grown mainly as rainfed crops in the lowland rice-based system in the terai, inner terai, or upland corn-based system in the hills. Growing of legumes such as lentil, chickpea, and grass pea is mainly confined to the terai regions, while warm-season grain legumes such as soybean, black gram, pigeon pea, and horse gram share about 28% in terms of area and production and have a special significance in the hill farming system. *Phaseolus* bean, mungbean, cowpea, rice bean, faba bean, and field pea occupy a small area (10%), but they are important as cash-generating crops. Grain legumes play a vital role in crop diversification, restoration of soil fertility, and the breakdown of disease cycles (Shrestha et al. 2011).

In eastern and southern Africa, farmers could double their yields simply by growing legumes for a year in between cereal crops. The problem of low yield was attributed to poor soil fertility and incidence of witchweed *Striga.* The rising population in the rural areas also indicates that land is cropped more intensively. Thus, farmers plant cereals such as corn, upland rice, sorghum, and finger millet annually instead of leaving the land crop-free to recover and to help control the witchweed. Farmers in Kyela, Morogoro, and Mbeya in Tanzania now rotate cereals and legumes. They dig in the legumes as green manure. In rice-legume rotations, witchweed populations dropped by half. These rotations could have a large impact in the region because many poor farmers cannot afford fertilizers or herbicides (RIU nd).

In Tanzania, farmers plant cabbage, tomato, sweet pepper, cauliflower, lettuce, and indigenous vegetables in the horticulture system (Putter, Koesveld,, and de Visser 2007). There was also a project led by Brunei Darussalam that introduced and promoted indigenous vegetables with added value or potential for commercialization and development of cottage industries in selected rural areas and in disaster-prone areas, establishing mechanisms to ensure sustainable conservation and utilization of indigenous vegetables (AVRDC nd). The project also aimed to develop a strategy for knowledge management to enhance public awareness; to support the advocacy for sustainable conservation and utilization of indigenous vegetables and the institutionalization of related activities; to develop a critical mass of human resources capable of providing training on conservation, promotion, utilization, product development, and marketing of indigenous vegetables; and to train women on utilizing these vegetables for food and nutrition.

In the Philippines, Calleja (2009) stressed that vegetables could address the malnutrition problem. A study conducted by BAR in partnership with the World Vegetable Center showed at least 10 promising indigenous vegetables that are now given priority for massive promotion. These arealugbati (*Basella alba*), ampalaya (bitter gourd) for leaves or *bayok-bayok* (*Momordica charantia*), *himbabao* (*Allaeanthus luzonicus*), *kulitis* (*Amaranthus*), *labong* (bamboo shoot), *upo* or bottle gourd (*Lagenaria siceria*), malunggay (*Moringa*), *pako* (fiddlehead), *saluyot* (*Corchorus*), and *talinum* (*Talinum triangulare*). The study was part of the project dubbed "Promotion of Indigenous Vegetable for Poverty Alleviation and Nutrition Improvement of Rural Households in the Philippines," which was implemented in the Philippines through the RFUs of DA and the National Nutrition Council in cooperation with the LGUs.

Other indigenous vegetables being promoted are eggplants, amaranths, cucurbits, radish, bottle gourd, luffa (smooth and ridged types), wax gourd, bitter gourd, snake gourd, squash, jute, *Basella*, kangkong, ivy gourd, basil, lablab, rosella, okra, yard long bean, winged bean, cucumber, tomato, and vegetable soybean. These indigenous vegetables were chosen based on nutrient content, medicinal and health benefits, non-food uses, and volume of production and food preparation. These are considered "indigenous" to the Philippines because they grow abundantly in the rural areas. But not everybody is aware of their value as food and as affordable and alternative sources of essential nutrients. These types of vegetables are easier to grow, are more resistant to pests, and are highly acceptable to local tastes. Because of these features, they are suitable as cash crops in peri-urban systems, as source of vegetables for daily sustenance in home gardens, as source of new crops, and as source of variation to achieve diversification in production systems and diets.

2.4 Community Participatory Action Research Approach

The CPAR program is one of the flagship programs of BAR geared at generating significant information by verifying the technical and economic feasibility of mature technologies prior to widespread adoption. It is a location-specific research cum extension activity that deals with improved farming systems technologies for specific micro agroclimatic environments within the province/municipality. The CPAR Grant aims to 1) enhance the role of research development and extension through technology transfer to improve production management systems; 2) develop strategies for effective integration of support services for enterprise and agribusiness development; and 3) institutionalize active community participation in the overall management of farm and coastal resources for enterprise and agribusiness development (DA BAR nd).

The community is empowered by organizing their own production management systems. The participatory nature of CPAR is intended to implement a holistic approach to the overall management of the production system. This includes integrated farming systems development; resource management orientation; and community-based, whole-farm, and whole-family-system approach, focusing on complementation and integration. These processes are instituted through a farm model framework focused on participatory

community-based resource management systems. The CPAR program, for its part, is managed by DA-BAR and implemented by the DA's Regional Integrated Agricultural Research Centers and Regional Integrated Fisheries Research and Development Centers as well as by LGUs.

One of the selling points of CPAR is enjoining farmers and fisherfolk as partners in designing and implementing agricultural projects, in the process empowering them to make informed decisions that will benefit the entire community (dela Cruz 2014). Through model farms, CPAR focuses on the needs of farmers and fishers and their families, thus bringing benefits at the community level. At the end of the chain, CPAR ensures that harvests of farmers and fishers will reach the market and, hopefully, elevate the new practices to widescale production and product promotion. Brion (2014) stated that the contribution of CPAR is not only to increase farmers' productivity and income in rice-growing areas through the development of appropriate and location-specific technologies and interventions but also to enhance the role of research and development in the transfer of technology, resource management, and agricultural sector productivity of the region.

Several programs and projects using the CPAR approach have been introduced in the country. Examples of these are as follows: 1) introduction of new banana production and processing technologies, which aimed to increase productivity of farmers in Alfonso Lista, Ifugao (Battad 2014); 2) adoption of improved fish production technology to increase the income of fish farmers by 20 percent in Lamut, Ifugao (Barral 2014); 3) development of a locally based motorized weeder in selected upland areas in Camarines Sur and Albay (Brion 2014); 4) introduction of organic farming and livestock production such as native chicken and cattle fattening in Tubungan, Iloilo (de Leon 2015); and 5) introduction of the new cropping system of rice – corn – corn + livestock farming system (dela Cruz 2015). In this last project, CPAR cooperators were also introduced to the use of organic fertilizer and/or compost + bio-fertilizer + inorganic fertilizer, use of a leaf color chart (LCC) to time nitrogen (N) application, use of light traps, release of biological control agents such as earwigs, and use of crop residues.

III. Methodology

The study sites are located in the Bicol region. The population of the region has consistently increased from 2000 to 2015, but its share to the country's population has consistently declined during the same period. This is reflected in its population growth rate that is not lower than the national figures, steadily declining during the same period (Table 1.1).

The economic and social indicators of Region 5 suggest a lower performance than the national level (Table 1.1). The high poverty incidence could be a factor in the declining annual growth rate of the population. Poverty incidence is higher in Region 5 than the whole Philippines. It is true that poverty incidence is declining for both Region 5 and the

Philippines; however, the reduction in poverty incidence was faster for the latter than for the former. The poorer condition in Region 5 is also mirrored in per capita gross domestic product (GDP). The per capita GDP of the Philippines is almost thrice that of Region 5. Surprisingly, unemployment rate in Region 5 was lower than that in the entire country, indicating lower productivity among individual workers.

Similar to economic indicators, the social indicator rates are lower for the Bicol region when compared with the national level. Infant mortality rate, which is an indicator of the health of the population, was lower in Bicol than in the Philippines in 2016, but this was reversed in 2018, implying a decline in the delivery of health services. Finally, the percentage of the population who can read, write, and compute on their own is lower in Bicol Region than in the Philippines in 2016 and 2018.

Table 1. Socio-demographic information, Bicol region, various years.

Item	Bicol Region	Philippines	Camarines Sur	Masbate
Population: 2000 (in '000)	4,687	76,507	15,555	7,0766
2010 (in '000)	5,420	92,338	18, 822	8,346
2015 (in '000)	5,797	100,981	19,525	8,923
Population growth rate (%):				
2000-2010	1.5	1.9	1.62	1.66
2010-2015	1.3	1.7	1.32	1.28
Population density (persons/sq km): 2000	259	255	282	170
2010	299	308	331	201
2015	320	337		
Share to total poor population in the Philippines (%):				
2006 (in '000)	2,280 (10.06%) (1^{st})	22,644		
2015 (in '000)	2,172 (9.91%) (1^{st})	21,927		
Poverty incidence among families (%):				
2006	35.4 (4^{th})	21.0	39.5	44.6
2012	32.3 (6^{th})	19.7	31.7	40.6
2015	27.5 (6^{th})	16.5	27.0	35.5

Per capita GDP (at constant 2000 prices)				
2014 (PhP)	24,719	71,741		
2015(PhP)	25,770	74,833		
2016 (PhP)	26,736	78,712		
Infant mortality rate (%)				
2008	19	25		
2011	25	22		
Functional literacy rate (%)				
2008	79.9	86.4		
2016	87.1	90.3		
Unemployment rate (%):				
2008	5.2	6.8		
2016	4.7	5.5		

Data entries retrieved from http:// psa.gov.ph, openstat.psa.gov.ph accessed July 5, 2018

The municipalities of Pamplona in Camarines Sur and Milagros in Masbate were chosen for project implementation. Pamplona, Camarines Sur, a 4th class municipality in the third district of Camarines Sur is one of 37 municipalities/cities of the province (Province of Camarines Sur, n.d). It is composed of 17 barangays with a total land area of 8,060 ha. Farming is considered the main source of livelihood of the people. Agricultural products include coconut, rice, vegetables, and root crops. Poverty incidence in the municipality is very high, estimated at 32.9% (PSA 2014) compared with the province's 27.1% (PSA 2016). Camarines Sur has a Type II climate (no dry season and heavy rains from December to January and little amount of rain expected from March to May).

Farming and fishing are the primary means of livelihood in Milagros. Almost half of the agricultural area of this municipality is devoted to crop production. Rice covers the biggest area among the major crops planted, followed by corn and coconut. The remaining portions are planted to legumes, root crops, vegetables, bananas, and other fruit trees such as mango (MAO 2008 cited in SDGF nd). The aquaculture industry in Milagros is focused mainly on milkfish (*bangus*), mudcrab (*alimango*) and tiger prawn (*sugpo*) production. The municipality has a vast tract of pasture land and is among the top producers of cattle in the province.

The project held initial meetings with community members to discuss the workplan schedule, project components, and expected outputs of the project. These five barangays have rice based rainfed farm areas under the Palayamanan scheme of PhilRice or are located at the tailend of irrigation areas or are agrarian reform communities (ARCs), or have a pond or a small dam.

For Pamplona, Camarines Sur, barangays Tampadong and Veneracion were selected as the study sites. These were not strictly upland farms but are still considered rainfed. Located in the Pamplona-Pasacao boundary, both barangays are rice-based, operating under a rainfed lowland ecosystem. Tampadong is less favorable to the rice-rice system, being slightly elevated and rolling. Hence, many farmers practice rice-vegetable cropping systems. Vegetables follow wet-season rice. The vegetable crops grown were the *pinakbet* varieties such as okra, bitter gourd, string beans, eggplant, bottle gourd, and *patola* (luffa). Vegetable

cropping extends until the next rice cropping. Many find vegetable production to give far better return than rice. Majority of the farmers practice rice-rice cropping. Construction of irrigation canals using pumped water from a nearby creek encouraged the sur-rounding farmers to practice the rice-rice system. The decision to follow the rice-rice or rice-vegetable cropping sequence, for many, is dictated by the general prevailing climatic regime. When rains can be expected, rice becomes the second crop. If dry season is apparently early, vegetables are planted as a second crop after rice. In some cases, rice-mung bean-fallow is practiced. Vegetables are either directly marketed in Naga City or picked up by wholesale buyers at the farm. Barangays Veneracion and Tampadong are characteristically under a favorable rainfed lowland ecosystem.

The municipality of Milagros is the study site in Masbate Province. As of 2012, poverty incidence was estimated at 49.6% (PSA 2014) higher than that for the province of Masbate at 40.6% during the same year (PSA 2015). In Milagros, Masbate, the chosen upland study sites were the two lowland rainfed barangays of Capaculan and Cayabon and the three upland barangays of Matagbac, Sawmill, and San Carlos. In the lowland barangays, other crops planted aside from rice are mungbean, sweet potato, traditional corn *(tiniguib*), cassava, peanut, and vegetables such as squash, sitao, and eggplant. Mungbean, vegetables, or root crops may follow rice as a second crop when soil moisture is still high or if there is a chance of late rains. Rice is the first crop planted during the wet season and cassava, corn, or sweet potato may also be planted side by side with rice. Crops are normally planted near each other but in separate areas.

A notable concern in the areas visited is land ownership (with the exception of a few farmers, San Fernando and Gutusan being ARCs. It was reported that many of the once-planted fields were converted into pasture lease areas, thus constraining areas of cultivation. In non-ARCs, farmers look around for pasture operators wholet them till the land. Since farming practice shifts in a 3-4-year cycle, continuous cultivation may be disrupted until a new area is found. Even in the ARCs, only a few remain for upland rice production. No watershed was observed in all areas visited.

By design, project implementation started with participatory rural appraisal (PRA).This PRA aimed to get a bird's eye view of agriculture and the agricultural resources of communities and to help farmers identify their problems and solicit suggestions on how to solve them A household baseline survey in all study sites followed the PRA, generating data on farmers' socioeconomic profile, technology adoption, access to credit, and availment of extension services.

It should be noted that, at the time of the project, the available curricula used for farmers' field schools were for lowland farming and climate change was a newly integrated topic. Hence, the team combined topics touching on lowland farming and the effect of climate on agriculture. These were further refined with baseline survey results as well as the PRA workshop findings. The module on livestock and poultry was also added, given that in the Palayamanan concept, goats and other ruminants form an essential part of the integrated approach.

The third major activity of the project was the training of trainers (ToT) for the CFS. Based on the curriculum, the topics were divided into four: climate, rice production, vegetable production and animal production management, and marketing of agricultural products. The resource persons came from DA RFU V, Central Bicol State University of Agriculture (CBSUA), and other entities. ToT participants were municipal agricultural extension workers from Camarines Sur and Masbate.

The heart of the project was the implementation of the CFS and the establishment of the techno demo farm. Farmers attended the CFS to learn and used the techno demo farm to apply the knowledge they just gained. A total of 234 farmers completed CFS, 145 of whom came from Milagros and 89 from Pamplona. This component culminated with the CFS graduation where participating farmers were recognized and given the chance to share their experience in front of local government officials, co-participants, and representatives from the DA RFO V, CBSUA, and UPLB.

To mainstream the Palayamanan cum CPAR approach in the municipal policy and planning process, the project organized events to share the learnings with the different components of CRDES 2. Training on ordinance making was done with the hope that municipal officials draft an ordinance to sustain the CFS activity.

Roundtable discussions and symposia were also organized to disseminate research output. Policy and planning instruments were developed and packaged for the integration of the Palayamanan approach into local agricultural development plans. These are the following:

3.1 Training on Mainstreaming Palayamanan and CPAR Approaches in Agricultural Development Planning

This 2-day training was organized to integrate farming systems of Palayamanan using the CPAR approach in the municipal agricultural development plan. Municipal agriculture officers, Sangguniang Bayan chairpersons for agriculture, and agricultural technicians from the different municipalities of Camarines Sur and Masbate were invited. This training also served as a venue through which mainstreaming through passing of ordinances and resolutions were discussed. The output was a draft a municipal resolution adapting Palayamanan and CPAR approaches as an initiative towards food security and community participation.

3.2 Roundtable Discussion (RTD) cum Regional Scientific Conference on Strategic Approaches to Mainstream Palayamanan using the CPAR Approach

This was the culminating activity of CRDES 2. The main objective of the RTD was to validate the results of research with partners from DA RFO 5, CBSUA, and LGUs These five research papers were presented: *Mainstreaming Palayamanan in the agricultural extension system using the CPAR approach: Participatory rural appraisal; Household survey results in*

Pamplona, Camarines Sur; Household survey results in Milagros, Masbate; Challenges and opportunities in conducting the climate field school in Camarines Sur and Masbate; and *Knowledge gains of the CFS farmer-graduates in Camarines Sur and Masbate*.

Meanwhile, the aforementioned regional scientific conference was conducted to share the research results to representatives of state colleges and universities in the Bicol region and all the other LGUs not directly involved in the project. The goal of this activity is for a more engaged and sustainable partnership between LGUs, RFOs, and the academe in conceptualizing, implementing, and monitoring agricultural development projects to reduce poverty and empower the people.

IV. Results and Discussion

4.1 Characterizing Communities and Households

The results of PRA in Camarines Sur show that the major problems in the said areas were lack of water resources, lack of farm inputs and farm machinery, and lack of modern knowledge in farming. For the rainfed lowland and upland study sites in Masbate, farmers encountered lack of water resources, pest infestation, lack of farm infrastructure such as farm-to-market roads, and lack of markets. Rainfed and upland farmers in the study area are mostly subsistence, living below the poverty line. Cultivating rice, corn, and vegetables and raising native hogs and poultry are mostly for home consumption. Farmers therefore aspire to increase their farm income as well as their ability to adapt to the vagaries of extreme weather events.

4.2 The Municipal Extension System in Bicol

The municipal agricultural office (MAO) does a lot of capacity building with farmers in the study sites. But lack of local travel funds prevents MAO officials from following up on the changes in practice of farmers based on lessons learned from these training programs. Through the national and regional programs, farmers in Camarines Sur were trained on new technologies through farmer field schools (FFS). Farmers residing in far-flung communities of Masbate have not attended such schools.

4.3 Introducing Palayamanan through the Climate Field School

Palayamanan was introduced in the study site through the conduct of the CFS), a half-day meeting done every week for the duration of the rice crop season. A curriculum for the rainfed and upland farmers was developed using the Palayamanan of PhilRice as the basic technology. The curriculum included modules on climate and other weather events, aside from modules on management strategies. Included in this scheme was a technological demonstration of Palayamanan, which is an improved farming system that aims to increase farmers' income in marginalized lowland and upland communities. The technological interventions were in the form of improved varieties for vegetables and more superior breed of goats and chicken.

CFS was a challenge to facilitators and farmer-participants. There was a decline in farmer attendance in Camarines Sur, while in the uplands of Masbate, attendance was nearly perfect. Females were observed to be going to school more often than males. They attended school to really learn about new technologies. In addition, they enjoyed going out of the house so they can socialize and look their best. CFS facilitators in upland Masbate needed to walk several kilometers to conduct the classes. They would usually come to the village a day ahead so that the early start can motivate farmers to come on time.

4.4 CFS Knowledge Gains

One of the analyses done in the project aimed to assess the knowledge gain of farmers who went to the CFS. It was observed that farmers had a significant increase in knowledge about climate, land preparation and seedling establishment, soil nutrients, pest management, and harvesting. Moreover, there were changes in farming practices after they finished CFS.

4.5 Impact on Income

In terms of impact on income of households, farmer-cooperators of CFS were able to produce vegetables with a market surplus. A market for bitter gourd emerged as the harvested crop was bought in the farmers' backyard and brought to the town proper and later to the city. As well, the roll-over scheme of the goat dispersal was a success in Masbate, which brought additional income to household beneficiaries. But, in some instances, produce from the techno demo farm was damaged by drought or severe heat brought about by the dry spell pervading in the area. This also signaled to the project team and farmers that some crops are highly susceptible to hot weather in the uplands. Altogether, the farmers felt that investing in improved crop varieties and high-quality livestock was a good way to increase income.

4.6 Sustaining the Gains

The project team held workshops for the municipal agricultural officers of Masbate and Camarines Sur so they can appreciate the benefits of Palayamanan delivered through the CFS. Municipal officials were also trained on the crafting of a local ordinance for the continued conduct of CFS beyond the project life, using the Palayamanan-based CFS curriculum. Future activities would involve further monitoring of changes in practices and income effects of the CFS. If there are known constraints, the MAO can seek support from the regional DA and LGUs. Though farmers have indigenous knowledge enabling them to adapt to extreme weather events, they still need new and climate-resilient technologies to minimize losses. Palayamanan is a promise of such adaptation measure.

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