STUDY

Rice and Vegetable Value Chains Affecting Small-Scale Farmers in the Philippines

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Right to Food

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Abbreviations

AHFF	Agriculture, Hunting, Forestry and Fishing
ATs	Agricultural Technologists
CDA	Cooperative Development Authority
CDP	Comprehensive Development Program
DA	Department of Agriculture
DA-RFO	Department Agriculture-Regional Field Office
DILG	Department of Interior and Local Government
DRR	Disaster Risk Reduction
DRRMP	Disaster Risk Reduction and Management Plan
ENSO	El Niño Southern Oscillation
EV	Eastern Visayas
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
GHGs	Greenhouse Gases
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
ICESCR	International Covenant on Economic, Social and Cultural Rights
IRRI	International Rice Research Institute
KII	Key Informant Interview
LGU	Local Government Unit
MAO	Municipal Agriculture Officer
MDP	Municipal Development Plan
MT	Metric Ton
NEDA-RO	National Economic and Development Authority-Regional Office
NFA	National Food Authority
NGO	Non-Governmental Organization
NIA	National Irrigation Authority
NPIC	National Pesticide Information Center
NPM	Net Profit Margin
NSIC	National Seed Industry Council
NSW DPI	New South Wales Department of Primary Industries
PCA	Philippine Coconut Authority
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development
PhilRice	Philippine Rice Research Institute
PhP	Philippine Peso
RA	Republic Act
ROI	Return on Investment
RP	Republic of the Philippines
RtF	Right to Food
SAC	Social Action Center
SARD	Sustainable Agriculture and Rural Development
SUC	State University and College
SRI	System of Rice Intensification
ST	super typhoon
UN	United Nations
UNCED	UN Conference on Environment and Development
UNGA	United Nations General Assembly
UNIDO	United Nations Industrial Development Organizations
UNLV	University of Nevada, Las Vegas
USAID	United States Agency for International Development
VSU	Visayas State University
WFP	World Food Programme
WFPP	World Food Programme Philippines

1 Introduction

The UN Declaration of the Right-to-Food

The Universal Declaration of Human Rights (UNGA, 1948) asserts that respect of the fundamental human rights, the dignity and worth of the human person, and the equal rights of men and women promote social progress and better standards of life. More particularly, Article 21 of the Declaration proclaims that everyone has the right of equal access to public services in his/her country and Article 22 further articulates that everyone, as a member of society, has the right to social security and is entitled to the realization, through national effort and international cooperation and in accordance with the organization and resources of each state, of the economic, social and cultural rights indispensable for his/her dignity and the free development of his/her personality.

In accordance with the principles of the Declaration, the member states of the United Nations further agreed on an International Covenant on Economic, Social and Cultural Rights (ICESCR). Article 11 (UNGA, 1966) of the Covenant recognizes the right of everyone to an adequate standard of living, which includes adequate food for him/herself and for his/her family. It further enjoins states to take measures to improve the methods of production, conservation and distribution of food to ensure that everyone would be free from hunger. To achieve these, states were to make full use of technical and scientific knowledge, disseminate knowledge of the principles of nutrition, and develop agrarian systems wherein natural resources would be efficiently utilized.


Coconut is the main source of income in rural areas of Samar island (© Caritas Czech Republic/Jakub Zak)

In 1992, the UN Conference on Environment and Development (UNCED, 1992) ratified Agenda 21 to address, among other issues, the worsening hunger, poverty and ill-health. Chapter 14 specifically stipulates the creation of conditions for sustainable agriculture and rural development (SARD) to increase food production in a sustainable way and enhance food security, and hopefully ensure stable supplies of nutritionally adequate food, access to those supplies for vulnerable groups, and production for markets. These aspirations were to be achieved primarily by maintaining and improving the capacity of agricultural land with a hight potential to support a growing population, while conserving and rehabilitating the natural resources of land with a lower potential.

Ten years later, during the World Summit on Sustainable Development (UN, 2002), the representatives of the peoples of the world concurred that eradicating poverty was the greatest global challenge and an indispensable requirement for sustainable development. They reaffirmed their collective commitment to halve, by the year 2015, the proportion of people suffering from hunger, by developing national programmes that reflect their priorities and enable them to increase access to productive resources (in particular land), public services and institutions, by providing access to agricultural resources for people living in poverty, especially women and indigenous communities, and by promoting appropriate land tenure arrangements that recognize and protect indigenous and common property resource management systems.

Right-to-Food Principles in View of Disasters

Known as the Disaster Risk Reduction and Management Act of 2010, the Philippine State adopted the policy to uphold the right to life by addressing the root causes of vulnerabilities to disasters, and by building the resilience of communities to disasters, including climate change impacts. One of the main focuses is to adopt the universal norms, principles and standards of humanitarian assistance to overcome human suffering due to recurring disasters and incorporate internationally accepted principles of disaster risk management in the creation and implementation of national, regional and local sustainable development and poverty reduction strategies. It emphasizes the need to adopt an approach that is holistic, comprehensive, integrated, and proactive in lessening the socioeconomic and environmental impacts of disasters, including climate change, and promote the involvement and participation of all sectors and stakeholders concerned (especially the local community).

The Policy mainstreams disaster risk reduction (DRR) and climate change in development processes and sectors (such as in the areas of environment, agriculture, water, energy, health, education, poverty reduction, land-use and urban planning, and public infrastructure and housing) and institutionalizes the policies, structures, coordination mechanisms and programs with continuing budget appropriation on DRR from national down to local levels towards building a disaster-resilient nation and communities. Important is to recognize the local risk patterns across the country and strengthen the capacity of LGUs for DRR and management through decentralized powers and responsibilities. Crucial part of the Policy is to develop and strengthen the capacities of vulnerable and marginalized groups to mitigate, prepare for, respond to, and recover from the effects of prospective disasters. For the individuals and families affected by disaster, the State is obliged to provide maximum care, assistance and services to and to implement emergency rehabilitation projects to lessen the impact of disaster.

In the implementation of international humanitarian assistance in times of disasters, the Philippines has adopted a mechanism, which includes the authorization of the import and donation of food, clothing, medicine and equipment for relief and recovery as well as other disaster management and recovery-related supplies.

Background Situation of Small-Scale Farmers in Samar

Profile of the Rice Industry in Eastern Visayas

Eastern Visayas (EV) region is located in the mid-eastern part of the Philippine archipelago facing the Pacific Ocean. By virtue of its geographic location, it is vulnerable to various geo-hazards, with typhoons being a predominant source of risk (NEDA-RO VIII, 2014). Reportedly, three super typhoons (ST) passed through Eastern Visayas between 1897 and 2013. The latest, super typhoon (ST) Haiyan (locally known as Typhoon Yolanda), hit EV on 8th November 2013, and brought destruction to the millions of people (See Figure 1.).

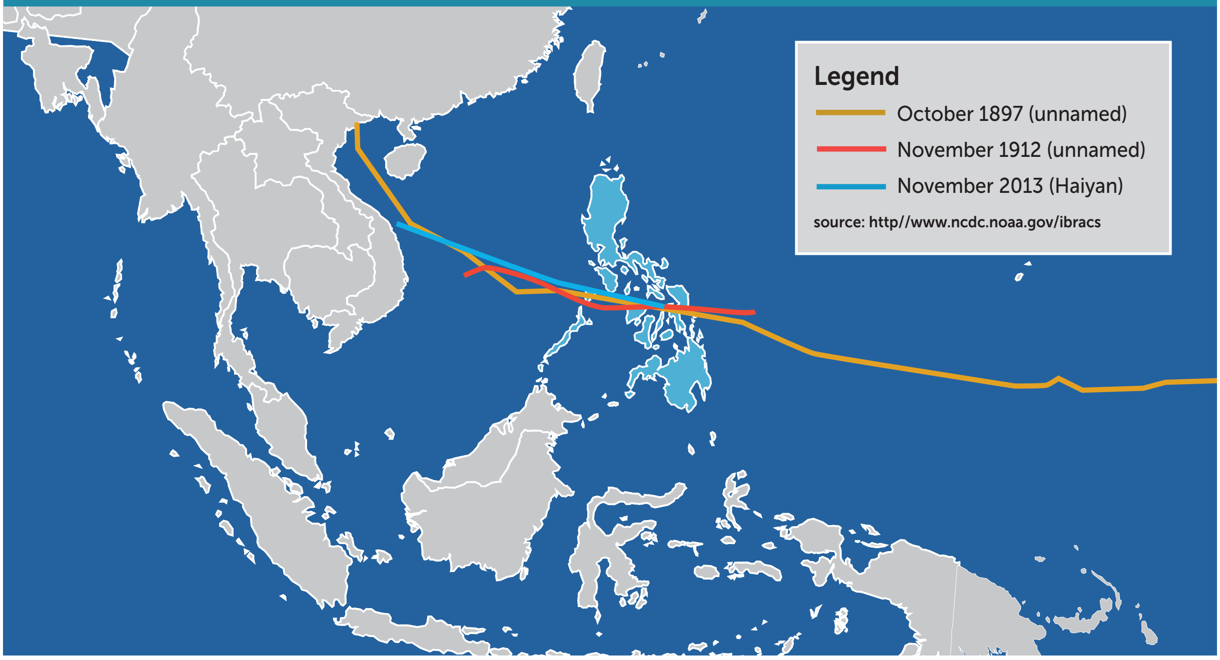
According to the Philippine Department of Interior Local Govenment (DILG), the hardest hit municipalities in the province of Samar were Marabut and Basey (NEDA-RO VIII, 2014) (See Figure 2.).

Even prior to ST Haiyan, one of the major challenges confronting Eastern Visyas had been poverty. In 2006, 41.5 percent of the population lived in the poverty. By 2009, the proportion of the poor rose to 46.6 percent, making EV the 5th poorest administrative region in the Philippines. In 2012, the year before ST Haiyan, there was a slight drop to 45.2 percent of the population, but EV was still the 2nd poorest region of the Philippines (NEDA-RO VIII, 2014).

One of the underlying factors contributing to the high poverty incidence was reportedly the low productivity of agriculture. In 2012, the economic sector of agriculture, hunting, forestry and fishing (AHFF) contributed only 22.6 percent to the Gross Regional Domestic Product (GRDP) despite the abundance of natural resources that could be tapped for farming and fishing. During the period 2011-2012, the contribution of the AHFF sector even shrank by 3.0 percent (NEDA-RO VIII, 2014).

Eastern Visayas has an agricultural land area of 723,048 hectares, 22 percent or 157,632 hectares of which has been devoted to rice cultivation (World Food Programme-Philippines, 2014). Rice was reported to account for 21.86 percent of the regional total agricultural output. *Palay*

Figure 1. *Map of the Philippines showing the tracks of Super Typhoons that hit Eastern Visayas between 1897 and 2013.*



Source: Mahar Lagmay, DOST-PAGASA, https://twitter.com/nababaha/status/402377875342376961/photo/1/large)

(or unmilled rice) production would usually be relatively higher during the January to June with 54 percent of total *palay* output, while the remaining 46 percent would be produced during July to December (BAS, 2011). As enunciated in the 2012-2016 Eastern Visayas *Palay* Development Roadmap (DA-RFO8, 2013), total production in the region tripled from more than 267,000 mt in 1970 to 964,000 mt in 2010. Highest production (1,100,000 mt) was reported in 2008, but production levels declined in the succeeding years due to strong typhoons that hit the region.

Apart from being a source of staple food, many families depend on rice cultivation for income. By applying proper rice production technologies, farmers could earn a net income of between PhP21,000 to PhP41,000, depending on the quality of the seeds planted, the cost of fertilizers, other production inputs, and the availment of crop insurance. This comes alongside the employment opportunities generated by rice farming operations (DA-RFO 8, 2015 as cited in Mangaoang, 2015).

During ST Haiyan, rice production in EV suffered production losses estimated at 34,221 MT (Table 1). The province of Samar incurred a loss of 2,717 MT (2,717,000 kg) or around 8 percent of the regional total production loss (DA-RFO, 2014 as cited in Mangaoang, 2015).

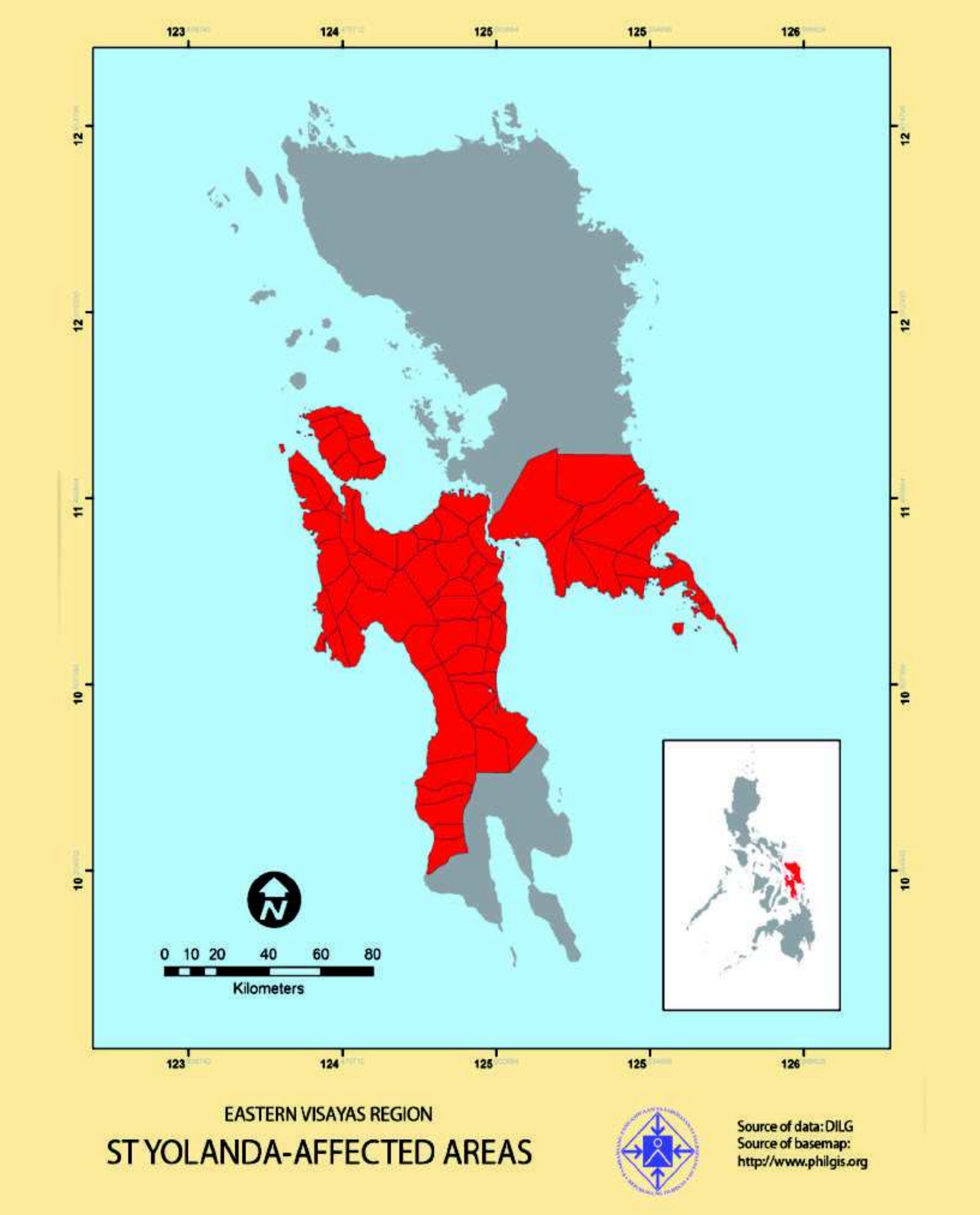
Commercial rice traders in Eastern Visayas source a large amount of their rice supplies from local producers. Higher quality rice, however, comes from Cebu, Iloilo, Mindanao and Manila. Trading and distribution were

Table 1. Rice Production Outputs of Samar and Eastern Visayas in 2012 and Production Losses due to Typhoon Yolanda

Indicator	Samar	Eastern Visayas
Production Output as of 2012 (mt)	140,529	994,972
Production Losses due to Typhoon Haiyan (mt)	2,717	34,221
Percentage of Damage to Production	1.93	3.43
Percentage of Damage to Regional Losses	7.94	100.00

*Source: *Department of Agriculture Regional Field Office 8, 2014*
***Food and Agriculture Organization, 2014*

Figure 2. *Map of Eastern Visayas showing the municipalities that were affected by ST Haiyan*



Source: Department of the Interior and Local Government. Republic of the Philippines.

Leyte (Tacloban City, Ormoc City, Baybay City, Albuera, Abuyog, Alang-alang, Babatngon, Barugo, Bato, Burauen, Calubi-an, Capoocan, Carigara, Dagami, Dulag, Hilongos, Hindang, Inopacan, Isabel, Jaro, Javier, Julita, Kananga, La Paz, Leyte, MacArthur, Mahaplag, Matag-ob, Matalom, Mayorga, Merida, Palo, Palompon, Pastrana, San Isidro, San Miguel, Sta. Fe, Tabango, Tabontabon, Tanauan, Tolosa, Tunga, and Villaba)
Samar (Basey and Marabut)
Eastern Samar (Balangiga, Balangkayan, Gen MacArthur, Giporlos, Guiuan, Hernani, Lawaan, Llorente, Maydolong, Mercedes, Quinapondan, and Salcedo)
Biliran (Almeria, Biliran, Cabucgayan, Caibiran, Culaba, Kawayan, and Naval)

temporarily stopped after ST Haiyan until the mid-2014, during which local traders and distributors already had access to enough stocks of rice to supply the market in the region (World Food Progamme, 2014). Major distributors, traders, and millers also sustained severe damage during the ST Haiyan. Of the ten largest traders in the region, two temporarily ceased operations, but are expected to resume operations as soon as their warehouses and machines got repaired. In the early part of 2014, some undamaged and repaired warehouses and transport fleets were leased out to international organizations while businesses waited for their operations to resume.

The National Food Authority (NFA) is the national government agency which handled the supply and retail of the very affordable rice. The NFA served 15 percent of the total supply needs of the region in 2014 with stocks coming from its depot in Cebu, and temporary warehouses in Baybay and Catbalogan while its main warehouse in Tacloban City was under repair.

In the initial rapid trade capacity assessment conducted in the region by the NFA right after the onslaught of ST Haiyan, municipalities were categorized into four market catchment areas based on the trade flows (Figure 3).

For this study, the following catchments were found to be of importance:

Tacloban Catchment. Running west from Tacloban City to Carigara, these markets were normally integrated with Tacloban City. However, due to supplier shocks stock replenishment was primarily from Ormoc City. Supply flow to this catchment area was stifled due to the closure of major distributors and millers since ST Haiyan. Commercial rice started to trickle into this area through small rice wholesalers who were buying stocks from millers in Ormoc City, Baybay City and other parts of the region. Prices ranged from PhP38 to PhP45 per kilo. Major markets include the city of Tacloban and the municipalities of Alangalang, Palo, and Carigara.

Catbalogan Catchment. This covered the Samar and Eastern Samar provinces. The southern coast of the Samar and Eastern Samar provinces (from Quinapundan going west to Basey) were normally integrated with the Tacloban Catchment, while the coastal towns of Eastern Samar (from Guiuan going north to Llorente) were integrated with both Tacloban City and Borongan City. The southern

Figure 3. *NFA facilities, Eastern Visayas, 2010*

Source: Geographic Information Systems. Visayas State University.

coast of Eastern Samar (including Basey and Marabut in Western Samar) depended on Tacloban City for trade and markets. The towns from Guiuan to Borongan of Eastern Samar were supplied by both Tacloban City and Catbalogan City. However, due to supply shocks, Catbalogan City became the main source of supply for commercial goods. This stifled the flow of goods towards the southern coast due to its considerable distance from Catbalogan City.

Regular distributors such as millers and traders in Tacloban City ceased operations and this negatively affected the flow of rice into this area. The supply of rice came in trickles from the unaffected areas in Western Samar and Northern Samar. Prices ranged from PhP38 to PhP48 per kilo. On the island barangays prices were even higher, from PhP45 to PhP50 per kilo. Major markets include Llorente, Gen MacArthur, Guiuan, Salcedo, Balangiga, and Basey.

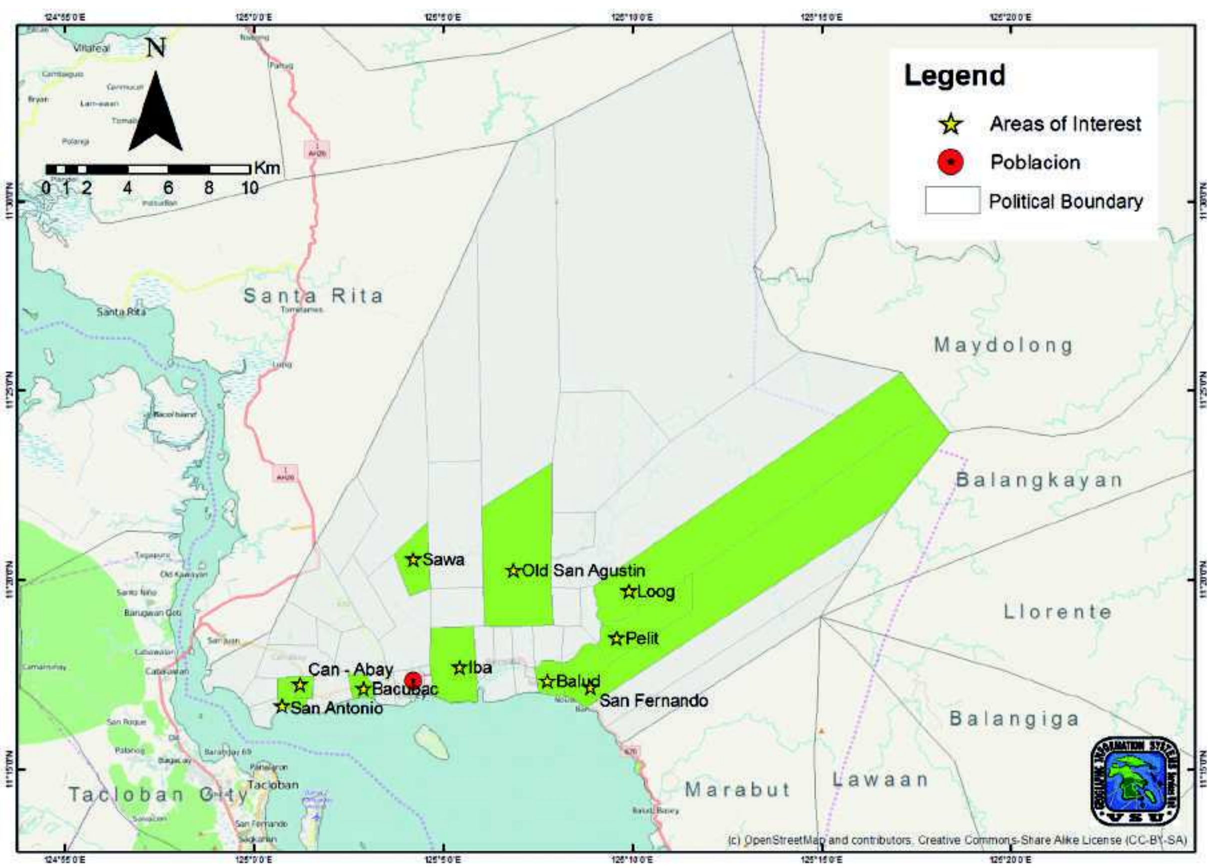
In late 2013 up to early 2014, rice supply was scarce on the market, particularly in the super typhoon-affected areas of Basey and Marabut. Some of the reasons, according to retailers, were: rice was no longer being sold on the market; rice retailers had stop selling rice and shifted to fast-moving consumer goods; and distribution from rice distributors to retailers had temporarily ceased. For those very few who were still selling, rice did not move for about three to four weeks. Since there was no competition on the market, sellers were selling at high prices.

Characteristics of Small-Scale Farmers of Samar

The Small-Scale Farmers of Basey

The major crop of Basey used to be coconut, but the exact area planted to coconut was difficult to ascertain due to the swampy geomorphology of a large portion of the municipality (See Figure 4). These lands had been described as having a vegetative cover characterized by coconut plantations, croplands mixed with coconut plantations, and cultivated areas mixed with bushlands and grasslands. This also encompassed varying planting densities for coconuts. The swamplands of Basey could potentially yield up to a ton of copra per hectare every three months through the artificial drainage of an

Figure 4. *Map of Basey showing the study sites*



Source: Geographic Information Systems. Visayas State University.

Basey, Samar, Philippines (©Caritas Czech Republic/Jakub Zak)

extensive portion of the swamplands. The walkthrough of some areas affected by ST Haiyan revealed that coconut farmers had collectively built artificial water channels to drain portions of the swamplands, thereby allowing the coconuts to perform better, in terms of yield, than those in the undrained areas. Moreover, the farmers discovered that for transport they could use the channels to float their harvested coconuts to copra dryers located near the highway. On the other hand, most of the undrained areas were used as ricefields with coconuts planted along the borders of the land parcels, mainly to serve as boundary markers. Many of these boundary-marker-coconuts were observed to be bearing very few nuts.

According to the Philippine Coconut Authority (PCA), ST Haiyan affected 15,146 hectares of coconut plantations being tended by 11,022 farmers. Based on the inventory, more than 1.4 million coconuts were totally damaged, and close to 60,000 were slightly damaged. The walkthrough in one of the affected barangays of Basey conducted in February 2014 indicated that damage to coconuts ranged from 88 to 100 percent.

The other major crop of Basey was rice, with rice production mainly carried out in the undrained areas and flood plains. Depending on the status of water availability, rice could be grown in an aggregate area of between 32,000 and 35,000 hectares. Average production could reach 2.5 tonnes per hectare per season.

According to the Municipal Agriculture Office (MAO), ST Haiyan affected an estimated 2,000 hectares of ricefields cultivated by around 2,500 farmers. Considering that most of the rice crop had already been harvested prior to the typhoon, damage to the ricefields was mainly in the form of saltwater intrusion brought about by the storm surge. The walkthrough indicated that seawater reached more than 2.25 kilometers from the coastline. However, considering the swampy nature of the terrain, the intruding saltwater could have been flushed back to the sea or diluted by the substantial amount of water permeating the area.

As a form of support for rice production, some barangays used to operate hand tractors that farmers could hire for PhP100 per hour, excluding the cost of diesel, of which

Transplanting of organic rice seedling in barangay Buena Vista (©Caritas Czech Republic/Jakub Zak).

one litre could be consumed per hour of operation. Reportedly, the engine of one tractor was damaged during the typhoon, but already repaired and in working condition during the walkthrough. Farmers, however, revealed that most of them had no money to pay for hiring of a tractor. Some of the farmers who paid the tractor fee wondered where the collected money went because when they asked for the list of users and the corresponding length of time of tractor use, the tractor operator merely answered that the records were lost during the typhoon.

Due to the peculiar geomorphological characteristics of southwestern Samar, most of the swamplands of Basey had supported the proliferation and growth of sedge locally known as tikog as a domesticated species associated with rice. Although, technically, it was not considered an agricultural crop, tikog had been the most important matting sedge in the country, and had been a major source of livelihood for many residents of Basey. A peculiar characteristic of rice production in Basey would be the practice of allowing tikog to thrive and grow together with the rice crop. With tikog ready to be harvested three months after rice planting, the stalks could be collected even before harvesting the rice. After collection, tikog stalks would be dried, dyed and woven into mats and other handicrafts.

Part of the undrained swampy areas had been used to grow *palawan* and *taro*. Two varieties of taro - *pilet* and *iniito* (a white variety), and *kahungot* (also a white variety but with longer stalks) were recognized as important crops in Basey. Tubers of the *pilet* and *iniito* variety were either sold retail at the Basey Public market for PhP100 for a bunch which contained seven pieces, or they were sold in bulk to the local wholesaler at a lower price. Tubers of the *kahungot* variety were sold at prices that varied depending on the size (roughly PhP8 to PhP10 each). Local products of taro included the *ira-id* and *sagmani*, but production of these food items had been limited. Taro leaves, on the other hand, were also sold in the barangay, and in the Basey public market as a vegetable for use in a local delicacy known as *dagmay*. Among local residents, taro leaves and stalks were commonly cooked and used to feed pigs, which were kept in backyard pigpens.

Other minor crops included bananas, sweetpotato, cassava, corn and vegetables. Lands categorized as cultivated areas mixed with bushlands and grasslands were also planted with bananas, sweetpotato and cassava. The common banana varieties in the municipality were the *basbaranon* (otherwise known as *cardava* or *saba*), *costa* and *baloy*. Before ST Haiyan, farmers used to sell their harvested *basbaranon* to a local wholesaler in the Basey public market at PhP100 per bunch. For the *costa* variety, another local buyer bought the bananas from the farmers for PhP60 per bunch.

Although the wind and the storm surge that accompanied ST Haiyan affected an estimated 100 hectares of banana plantations cultivated by 50 farmers, many of the farmers were able to rescue some of the affected plants. Moreover, the *saba* or *basbaranon* variety was able to recover and bear fruit. Unfortunately, the farmers were no longer able to sell their *basbaranon* to the local wholesaler because he died during the typhoon. The other buyer in Basey continued to buy bananas from the farmers, but production was quite low so most were consumed as food at home.

Sweetpotato and cassava were sold for PhP250 to PhP300 per can (equivalent to 20 litres in volume). This could further be sold retail for PhP20 per pile (2 to 2.5 kg. per pile). Although these products were observed during the walkthrough of Basey public market, no municipal-level data were available to indicate the extent of production of these crops. Official damage reports did not include the extent to which the typhoon affected rootcrop production in the municipality. Although sweetpotato, cassava and taro were not affected by the wind, those that were reached by the storm surge manifested some degree of burns from the saltwater. As a result, they had to struggle against the effects of being buried in mud or in silt. Apparently, the immediate losses were in the vegetative parts of sweetpotato and taro, which could have been used as vegetables. Although a substantial quantity of tubers were harvested after the storm surge, those that were left in the fields were observed to have either withered or rotted away, or continued to grow, albeit in a stunted state.

One recommendation by the farmers, which could also have an impact on the physico-chemical dynamics of the swamp, involved the improvement of irrigation. Although such recommendation was made based on the desire to ensure water supply to areas that were traditionally cultivated as paddy fields but which were already experiencing some degree of water shortage, the inadequate characterization of the swamplands of Basey could limit the appropriateness of the suitability indicators. For example, any engineering intervention to alter the water regime could affect the retention or leaching of soil nutrients. And, providing more irrigation water could increase the release of swamp gas (methane), which is a more potent green-house gas than carbon dioxide. Draining the swamplands, on the other hand, could decrease the release of methane but increase carbon dioxide emission.

The Small-Scale Farmers of Marabut

The Municipality of Marabut is the southernmost municipality of the Samar Province, which is located on the western side of the Samar Island of the Eastern Visayas Region. It is bounded by the town of Basey in the north, by San Pedro Bay in the west by the Leyte Gulf and Lawaan Bay in the south, and by the municipalities of Llorente and Lawaan of Eastern Samar in the east. The municipality has a total land area of 14,354 hectares, of which 8,442 hectares (58.81%) are classified as timberland, 5,748 hectares (40.04%) as arable land, and 79 hectares (0.55%) as residential and institutional areas. It is politically subdivided into 24 barangays, 23 of which are coastal ones. Barangay Tag-alag is located in the interior northeast portion of the municipality. The most recent survey indicated a total population of 14,661.

The municipality is characterized by rugged mountains and rolling hills, which gradually slope down to the coastal lowlands, where most of the settlements are located. Barangay Tag-alag, on the other hand is located along the southern bank of the Legaspi River. A wider portion of the level areas is located in the northwestern half of the municipality from Brgy. San Roque to Brgy. Canyoyo. However, the upper portion is interspersed with mangroves and steep rock formations of limestone, which is a distinct and unique geophysical feature of Marabut.

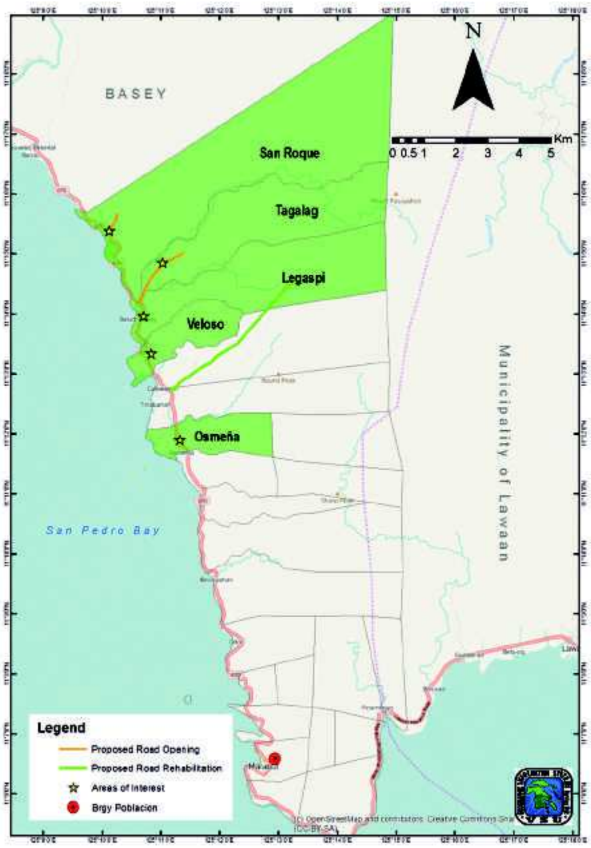
Of the 14 354 hectares land area of the municipality, more than 58 percent was classified as timberland and not inhabited. The arable lands covered some 40 percent. Only a very small portion was occupied by its population is due to the hilly and mountainous topography of the area. The total built-up area of the municipality was only 79 hectares. This is even less than 1 percent of the municipal total land area. The populated settlements were all located along the coast except Barangay Tag-alag. The total built-up area comprised of 9.5 hectares for the urban area. The town proper, which is located in the southern part, consists of four barangays, falls under this category. The rest of the populated area, comprising 69.9 hectares, was considered rural areas (See Table 2.).

Marabut has a sub-urban built-up area consisting of 19.3 hectares at the northern part, which was much

Table 2. Area of Various Land Use Categories in Marabut

Land Use Category	Land Area (in hectares)	% to Total Land Area
Arable Land/ Agricultural Area	5,748	40.04
Built-up Area	79	0.55
• Residential	59	0.41
• Institutional	20	0.14
Open Areas	85	0.59
Timberland	8,442	58.81
Total Land Area	**14,354**	**100**

Figure 5. *Map of Marabut showing the study sites*



Source: Geographic Information Systems. Visayas State University.

bigger than the town center. It has a wider plain, and its population growth was influenced by the commercial timber company that once occupied Marabut in the previous years. The built-up area for the urban category consists of residential, commercial, institutional, parks, and open spaces, cemetery and vacant lots. More institutions are located in the urban center which differentiates it from the rural built-up areas (See Figure 5).

Prior to ST Haiyan, the major crops of Marabut were coconut, rice, corn, sweetpotato and cassava. Coconut was mostly processed into copra. ST Haiyan destroyed an estimated 2,766 hectares of coconut plantations tended by 1,936 farmers, with more than 250,000 coconuts totally damaged and more than 20,000 severely damaged. The damage to coconuts, which averaged 85 percent, would suggest that in about a year, copra production could resume albeit at 30 percent of pre-Haiyan levels.

Another source of livelihood, which was destroyed together with the damage to coconuts, was *tuba* (coconut toddy) gathering. Key informants revealed that *sanggutan* (coconut from which sap would be collected) could yield more than six gallons of *tuba* per day. Locally, *tuba* could fetch up to PhP60 per gallon.

Rice was mostly cultivated in the western corner of the municipality in the areas where the swamplands were located.

Corn would either be planted as an intercrop in coconut plantations on land classified as cultivated areas and bushlands (estimated to cover 12,000 hectares), or as a succession crop in the farms located in open canopy forests (estimated to cover 4,000 hectares). According to the key informant, many farmers planted corn before the typhoon. Farmer reported using three kilograms of seeds for a ½ hectare corn field, from which an estimated 300 ears of corn could be harvested. Harvesting was staggered, with only about 50 ears being picked per day. Each ear would be broiled and sold in the barangay for between PhP5.00 and PhP10.00 depending on the size.

Similarly, sweetpotato and cassava were cultivated as intercrops to coconut, or as secondary crops in the farms. Sweetpotato was cultivated in *kaingin* farms, and in between fully-grown coconuts. The local varieties included *kaulpot, kamail, kasima, kapungko, inuring-ing* and *sinawa*. Among these varieties, *kapungko* was considered the best because it could be harvested in three months. The other varieties took four months to mature. Selective harvesting in a 0.5 hectare parcel of land planted to sweetpotato could be done every two weeks, with ten to 15 kilograms per harvest. The tubers could be sold for PhP30 per kilogram.

Farmers planted cassava any time of the year, and started harvesting seven months after planting. Harvesting was not a one-time event, and was done daily until all the plants had been harvested. A one-hectare cassava plantation could last for one month of daily harvesting of five hills per day. The harvested tubers could fill a 20-litre tin can (approximately 15 kilograms), a quantity that was considered to be just enough for one person to carry from the farm to home. Most of the local cassava production

Communal gardens contributes to diversification of agriculture in Samar (©Caritas Czech Republic/Jakub Zak).

was consumed as food. For this purpose, farmers recognized *makan* as the best variety. It was usually cooked in coconut milk, dipped in sugar and eaten during meals or as a snack. If there was enough, some farmers sold the cooked cassava locally at PhP10 per pack of about 200 to 250 grams.

Besides the coconuts, typhoon also destroyed food crops, which included 13 hectares of cornfields cultivated by 30 farmers, 10 hectares of banana plantations cultivated by 3 farmers, and 6 hectares of vegetable farms cultivated by 144 farmers. Farmers whose corn crops were not totally damaged also had difficulty harvesting their crops because monkeys raided their fields. Although these farmers had prior experience in encroachment by Philippine macaques, they observed that after the typhoon the monkeys were more aggressive in raiding their farms. Few cassava plants that survived the typhoon were harvested for food. Considering that coconuts were no longer available, the tubers were simply cooked by being boiled in water and dipped in salt. The sale of cooked cassava was discontinued as farmers reserved their harvestable tubers for their own food needs.

During the February 2014 FGDs with farmers, the recommendations for the rehabilitation of agriculture-based livelihoods revolved around three major themes: soil testing, market study, and capacity building. Soil analysis should be conducted to determine the types of crops that would be locally appropriate. Both the MAO personnel and barangay leaders should be trained in conducting field-level soil analysis to allow the community to perform soil testing on a regular basis. Aside from soil analysis, farmers were interested to learn farm planning, especially in formulating product commercialization strategies, and to increase their productivity through training on technical crop production and management. This intervention would require that Agricultural Technologists (ATs) be trained, considering that after the devolution of agriculture to the LGUs, capacity building activities for them had become rare.

2 Impact Assessment using the Right-to-Food Approach

Questions asked

Results of the study are reflecting findings related to

a. the situation of poor farmers in Samar in terms of food production before the typhoon.
- What was the state of their access to markets before typhoon Yolanda, and what would be the current situation?
- How were the value chains of agricultural products structured before typhoon Yolanda, and what was the situation and developments afterwards?

b. What challenges did farmers face for them to effectively enter local markets?
- Who were the main players in agri-enterprise development in Western Samar and Leyte?
- What would be the potential of value chain development for organically-produced rice and vegetables in Samar and Leyte?
- What links existed between the Right-to-Food approach and disaster resilience for small-scale farmers?

c. How did a large-scale natural disaster influence the production activities and access to markets of small-scale farmers?

Methodology used

Description and Analysis of Agricultural Enterprise Development within the Context of Pro-poor Growth

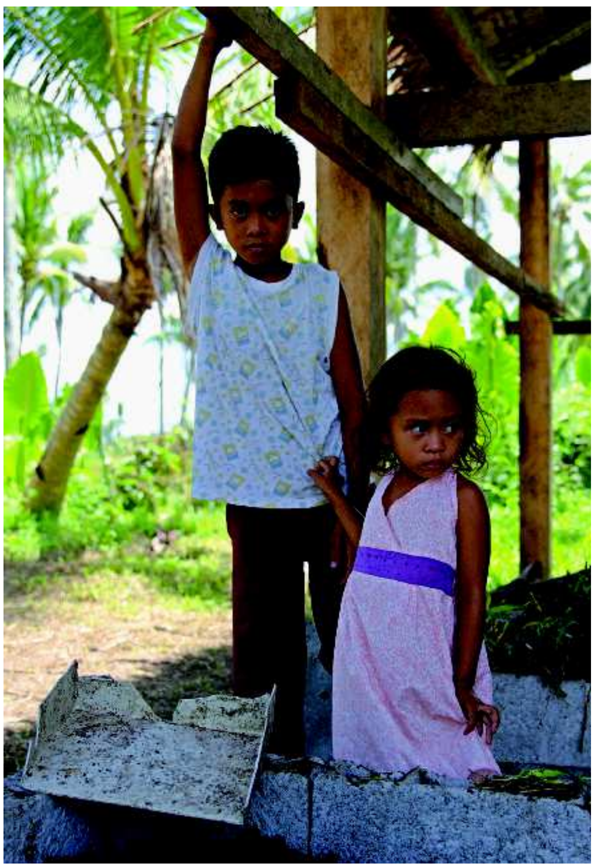
The major data collection activities included:

a. Collection of secondary data regarding the subnational economy from official statistics, local research and other published reports for Samar Province and the Eastern Visayas Region;

b. Collection of secondary data and review of research literature on the relevant value chains for rice and vegetables, which served as bases for the conduct of key informant interviews with relevant players in the value chains;

c. Collection of primary data regarding local producers and processors, and external players in the economic system and agricultural value chains including formal and informal trade through:
- key informant interviews (KIIs) with municipal-level key stakeholders; and,
- focus group discussions (FGDs) with barangay and community-level primary and key stakeholders (see Table 3).

Based on the review of secondary data and the KIIs with municipal-level stakeholders, five rice producing barangays were identified for Basey, and another five for Marabut. In addition, nine barangays in Basey were reported to be vegetable producing, while only six were reported for Marabut. During the conduct of the FGDs, five barangays were included for Basey, and six for



Children observe the distribution of earthworms as a way to support agri-production in Samar (©Caritas Czech Republic/Jakub Zak).

Table 3. Summary information regarding the FGDs conducted with stakeholders

Variable	Basey		Marabut		Combined	
	n	%	n	%	n	%
Number of rice-producing barangays	5	50.00	5	50.00	10	100.00
Number of vegetable-producing barangays	9	60.00	6	40.00	15	100.00
Number of barangays included in the FGDs	5	45.45	6	54.54	11	100.00
Total number of FGD participants	68	49.16	86	56.84	154	100.00
Average number of FGD participants	13	48.74	14	51.25	27	100.00

Table 4. Socio-demographic characteristics of FGD participants from the study sites

Variable	Basey		Marabut		Combined	
	n	%	n	%	n	%
Average number of FGD participants	13.6	48.74	14.5	51.25	27.9	100.00
Average number of male participants	4.6	35.11	8.5	64.88	13.1	100.00
Average number of female participants	9.0	60.69	5.8	39.31	14.8	100.00
Total number of barangay officials	11	28.94	27	71.05	38	100.00
Total number of FA officers and members	29	42.64	39	57.35	68	100.00
Total number of WA officers and members	11	34.37	21	65.62	32	100.00

Marabut. Participation in Basey only reached an average of 13 farmers per FGD, while in Marabut about 14 farmers attended per FGD.

The participants of the FGDs in Basey were usually women, while those in Marabut were mostly men. Of the barangay officials who participated in the FGDs, 71 percent were from Marabut and only 29 percent from Basey. In terms of being officers and members of farmers associations, 57 percent were from Marabut, with only 43 percent from Basey (Table 4.).

d. Identification of community-level agricultural resources through:

- Site-based agroecosystem inventories
- Limited farmer-level KIIs

Rice-based Agroecosystem

Five rice-producing barangays within the town of Marabut (namely San Roque, Tag-alag, Legazpi, Veloso and Osmeña) were identified as study sites. Sampling was undertaken following the Quadrat Method where a total of sixteen 1m x 1m quadrats were laid in five barangays. In Basey, 25 plots were laid in nine barangays, Bacubac, Sawa, Old San Agustin, San Antonio, Can-abay, Iba, Pilit, Loog and San Fernando. Geographic location of each plot was determined using the Global Positioning System (GPS). Within each plot, the planting distance was measured, and the number of hills and the number of tillers were counted. In addition, associated species were identified, counted and recorded. Rice land owners were also interviewed to know the farming practices that influenced their food production system (Table 5.).

Vegetable-based Agroecosystem.

Six *pinakbet* vegetable-producing barangays (San Roque, Tag-alag, Legazpi, Veloso, Osmeña and Lipata) of Marabut were identified and included in the inventory. In Basey, the inventories were conducted in eight barangays (San Fernando, Balud, Iba, Can-abay, San Antonio, Old San Agustin, Sawa and Bacubac). Sampling was conducted following the Quadrat Method with a total of 25 plots or an average of three 5 m x 5 m (min = 2, max = 6) quadrats being laid out per barangay in Marabut. In Basey, 23 plots were laid out in eight barangays. The difference in the number of plots was based on the consideration that Basey

Table 5. Summary information regarding the rice-based agroecosystem inventories conducted in the study sites						
Variable	**Basey**		**Marabut**		**Combined**	
	n	%	n	%	n	%
Number of rice farm parcels inventoried	25	60.98	16	39.02	41	100.00
Average number of rice farm parcels inventoried per barangay	2.7	45.76	3.2	54.24	5.9	100.00
Average number of rice farmers interviewed	2.5	40.32	3.7	59.68	6.2	100.00

Table 6. Summary information regarding the vegetable-based agroecosystem inventories conducted in the study sites						
Variable	**Basey**		**Marabut**		**Combined**	
	n	%	n	%	n	%
Number of vegetable gardens inventoried	23	47.92	25	52.08	48	100.00
Average number of vegetable gardens inventoried per barangay	2.9	40.85	4.2	59.15	7.1	100.00
Average number of vegetable growers interviewed	3.0	57.69	2.2	42.31	5.2	100.00

had more vegetable-growing barangays than Marabut. Geographic location of each plot was determined using GPS. Within each plot, the planting distances was measured, and the number of hills and associated species were identified, listed and counted. For gardens smaller than 25 sq. metres, actual size was measured. Garden owners were also interviewed (Table 6.).

Value Chain Systems Analysis

Structural Characteristics of Value Chains

A value chain, composed of actors connected along a sequenced set of activities which produces, transforms and brings goods and services to end-consumers. They could function properly through some sort of coordination. Value chains would also depend on services such as transport infrastructure, electricity and water supply, finance, management support and accounting services, knowledge provision, research and information services. A segment, or a vertical part of a value chain, would relate to certain functions, such as primary production, first-level processing, second-level processing, or marketing (UNIDO, 2011).

The structure of the value chain would influence the dynamics or behaviour of an enterprise, and these dynamics would determine how well the value chain would perform. The process of value chain analysis would require the use of a framework to identify: 1) the structure of the chain, including all individuals and firms that would conduct business by adding value and helping move products toward the end markets, and 2) the dynamics of the value chain, which would determine individual and firm behaviour and their effects on the functioning of the chain (USAID, undated).

Structure of a Value Chain

The value chain framework, according to the USAID, describes the structure of a value chain, to includinge all the firms in the chain and characterized in terms of five elements: end markets, business enabling environment, vertical linkages, horizontal linkages, and supporting markets. End markets are the starting point forof the value chain analysis.

End markets, the starting point of a value chain, would refer to people, not locations. They determine the characteristics including price, quality, quantity and timing of a successful product or service. Being a powerful voice and incentive for change, end market buyers provide important demand information, transmit learning, and, in some cases, invest in firms further down the chain. End-market analysis would involve the assessment of market opportunities with current and potential buyers, and should take into consideration trends, prospective competitors and other dynamic factors.

Business enabling environment would include norms and customs, laws, regulations, policies, international trade agreements and public infrastructure (e.g. roads and electricity). Analysis of the business enabling environment should determine whether and how it could facilitate or hinder the performance of the value chain, and where and how could it be improved.

Vertical linkages between firms at different levels of the value chain would be critical for moving a product or service to the end market. Vertical cooperation would reflect the quality of the relationship among firms up and down the value chain. More efficient transactions among firms would increase the competitiveness of the entire industry. In addition, vertical linkages could facilitate the delivery of benefits and embedded services, and the transfer of skills and information between firms up and down the chain. The nature of the vertical linkages, including the volume and quality of information and services disseminated, would often define and determine the benefit distribution along the chain and create incentives for further utilization. Moreover, the efficiency of transactions between vertically linked firms in a value chain would affect the competitiveness of the entire industry. An important part of value chain analysis would be the identification of weak or missing vertical linkages.

Horizontal linkages, both formal and informal, between firms at all levels in could reduce transaction costs, create economies of scale, and contribute to increased efficiency and competitiveness of an industry. In addition to lowering the cost of inputs and services, horizontal linkages could contribute to shared skills and resources and enhance product quality through common production standards. Such linkages could facilitate collective learning and risk sharing while increasing the potential for upgrading and innovation. One of the objectives of value chain analysis would be to identify areas where collaborative bargaining power could reduce the cost or increase the benefits to small firms operating with in the chain.

Seedling nursery widely used in rural areas, Samar
(©Caritas Czech Republic/Jakub Zak).

Supporting markets could include financial services and other cross-cutting services such as business consulting, legal advice and telecommunications, and sector-specific services (for exampe irrigation equipment or handicraft design). Not all services could be provided as embedded services by value chain actors, and so vibrant supporting markets would often be essential for competitiveness. Service providers might include for-profit firms and individuals, as well as publicly funded institutions and agencies. Support markets would operate within their own value chain in addition to strong vertical and horizontal linkages. Most service providers themselves need supplies, training and financing. Value chain analysis should therefore seek to identify opportunities for improved access to services for target value chain actors in such a way that the support markets could be simultaneously strengthened, rather than undermined.

Value Chain Approach to Development

The value chain approach, one of several market systems approaches to development, had been anchored on the belief that the poor and their economic opportunities had been profoundly influenced by the dynamic systems in which they had been participating in. By influencing how these systems perform, improved opportunities and outcomes for the poor could be achieved. The value chain approach would also seek to understand the firms that operate within an industry (from input suppliers to end market buyers, the support markets that provide technical, business and financial services to the industry, and the business environment in which the industry had been operating) because the principal constraints to competitiveness could lie within any part of this market system or in the operative environment. Failure to recognize and incorporate the implications of these constraints could generally lead to limited, short-term impact or even to counter-productive results.

Value Chain Governance

Value chain governance would refer to the relationships among the buyers, sellers, service providers and regulatory institutions that operate within or influence the range of activities required to take a product or service from inception to its end use. Governance would deal with the ability to exert control along the chain especially that at any point in the chain, a firm (organization or institution) can attempt to set and enforce parameters under which others in the chain should operate. Value chain governance could be market-based where there are only "arm's length" transactions between buyers and sellers with little or no formal cooperation among participants. Balanced value chain governance could be characterized by fairly equal decision making among chain participants, where there would be cooperation but no one would dominate.

There are three network-style modes of governance lying between arm's length and hierarchical governance: modular, relational, and captive. Network-style governance would refer to situations wherein the lead firm would exercise power through coordination of production vis-à-vis suppliers (to varying degrees), without any direct ownership of the firms. Modular governance would occur when a product would require the firms in the chain to undertake complex transactions thatcould easily be codified. In a relational governance, interactions between buyers and sellers would be characterized by the transfer of information and embedded services based on mutual reliance regulated through reputation, social and spatial proximity, family and ethnic ties, and the like. In captive chains, small suppliers are dependent on a few buyers that would often wield a great deal of power and control. Such networks would frequently be characterized by a high degree of monitoring and control by the lead firm.

Data Sampling and Gathering Procedure for Value Chain Studies

The study used both primary and secondary data collection. Primary data collection was done through Face-to-Face KIIs in the rice value chains. The rice and vegetable value chain players identified and interviewed were sampled from the rice and vegetable producing barangays identified by the MAO of the two municipalities (Table 7.).

Using research literature on the relevant value chains for rice and vegetables showing the inventory of value chain players, KIIs for rice value chain were classified as the farmers/primary producers, millers and rice traders (wholesaler-retailers); and the vegetable value chain as follows: farmers/primary producers, vegetable wholesalers and vegetable retailers.

The respondents were identified using purposive sampling. The other players in the chain were identified using snowball sampling, also known as "referral". The list of rice and vegetable farmers was sourced from the

Table 7. Summary information regarding the key respondents for the value chain analysis in the rice-growing barangays of Basey and Marabut, Samar (as of September 2015)

Value Chain Players	Basey		Marabut		Combined	
	n	%	N	%	n	%
Number of rice farmers interviewed	28	71.00	20	29.00	48	100.00
Number of rice millers interviewed	7	86.00	1	14.00	8	100.00
Number of rice traders interviewed	3	40.00	5	60.00	8	100.00

Table 8. Summary information regarding the key respondents for the value chain analysis in the vegetables-growing barangays of Basey and Marabut in 2015

Value Chain Players	Basey		Marabut		Combined	
	n	%	N	%	n	%
Number of vegetable farmers interviewed	23	33.00	34	67.00	57	100.00
Number of vegetable retailers interviewed	2	20.00	8	80.00	10	100.00

Barangay Committee on Agriculture from of the rice and vegetable producing barangays. The rice millers were identified through referrals from the rice farmers. Rice and vegetable traders were referred by the end consumers of rice and vegetables.

The snowball sampling technique was used in the selection of the value chain actors as respondents. This involved tracing the rice and vegetable value chains (for both downstream and upstream nodes). The upward tracing began with the identification of the first of the downstream players (or the relevant market, mainly the customers who define the value of the products), and then locating the other upstream actors (up to farm level) in the value chain.

In this study, the identification of rice value chain key players as respondents started with the registered rice millers from the towns of Basey and Marabut whose names were taken from the municipal records. A list of major millers from the National Food Authority Region 8 Office in Tacloban City served as a secondary data source document for identifying the rice value chain downstream players.

The identification of the vegetable value chain key players as respondents started with the local vegetable traders from the municipal markets of Basey and Marabut. The upstream players were traced based on referrals from the key informants downstream and up to the farm levels.

Key Informant Interviews (KIIs). Primary data used to analyse the rice and vegetable value chains were gathered through Face-to-Face Key Informant Interviews using structured interview questionnaires. The types of data gathered were based on the six key analytical questions (PCARRD, 2011). These questions were asked in every segment of the rice and vegetable value chains. The six key questions are as follows:

1. *Who are the key customers and what are their product requirements (e.g. quality and standards)?* The customers of the products flowing in the value chain define the value they look for in the product. The customers include the market or buyers of rice and vegetables and their quality requirements (basis of quality, terms of trade, packaging, grades and standards) and others.
2. *Who are the key players in the chain and what are their respective roles?* This involves looking at the key actors and their respective roles in each segment, as well as the influences that are involved in each activity at every segment of the chain.
3. *What are the activities and processes along the chain?* As the product moves along the chain, activities that add value to the product are performed. This involves the various activities that happen and the services that are provided at every segment of the chain, from the rice/vegetable traders (wholesaler-retailers) to the farmers' activities.
4. *How do product, information and money flow through the chain?* The product flow from production undergoes transformation and moves to the other segments in the chain until it reaches the consumer. The income then flows from the consumer to the other players in the chain and back to the producers. This involves analysis of the volume of vegetables, paddy and rice traded sources, trading arrangements, price and pricing decisions, among others.
5. *What are the critical issues related to logistics?* This involves looking at the critical issues that arise as rice or vegetable is moved from one chain player to another. It covers the details of volume of vegetables, and paddy and rice traded, including the problems that can contribute to the deterioration of product quality,

Worms (African Night Crawlers) are being used as a medium for vermicomposting an excellent soil additive, conditioner and organic fertilizer (©Caritas Czech Republic/Jakub Zak).

problems or constraints in the handling and trading of the product, problems related to sourcing and delivery of the product, and others.

6. *What are the external influences affecting the performance of the value chain?* This involves the examination of support from government, non-government and private sectors to the value chain, including support programs, financial and technical assistance and other problems that affect the performance of the value chain. Specific external influences should come from ordinances, regulatory requirements, policies, and others.

Focus Group Discussions (FDGs) with farmers, community-based chain players and sectors who could influence the value chain segments and their activities were conducted to validate information and to gather additional data that were not captured in the structured interviews with KIIs. The FGDs questions were categorized in the following themes:

The pre- and post-Yolanda production situation (area planted)
The volume of production (sufficiency of produce for own consumption)
The markets for their products and access to market
Availability and access to farm production inputs and capital
Support programs and assistance received
Problems and constraints encountered

Data Analysis

To depict the linkages of the players in the rice and vegetable value chains, value chain maps were plotted. The performance of the players in each segment of the chain was analysed using the following *Value Added* and *Costs and Returns* performance indicators.

Value Added referrs to the amount of wealth generated by a player in the chain, and calculated as selling price less the total cost incurred from the inputs used and purchased. The computation of the value added generated throughout the chain would determine which among the value chain segment would have the highest value created and could help in developing possible chain upgrading strategies. The equation for calculating value added is

Value Added = Selling Price per Unit – Total Cost per Unit

Costs and Returns analysis helps to determine the profitability of each key player in the value chain, excluding the final consumers. The Net Return was calculated as total revenue less total cost incurred in every node of the value chain (material, labor, depreciation, overhead, etc.). To further assess the profitability and efficiency of the chain, Net Profit Margin (NPM) and Return on Investment (ROI) were also computed to determine the overall effectiveness and efficiency of each of the players in generating profit with its available assets and resources. The equations used in the cost and return analysis were

Net Returns (Net Loss) = Sales Revenue – Cost of Goods Sold

This aspect of the study involved conducting community-level FGDs to determine the relative contributions of the commodities of interest in the various levels of governance hierarchies, particularly in terms of farmer competitiveness and market access, consumers for farm products, and key limitations brought about by inadequate business skills, market linkages and access to information.

At the secondary level, the integrative analysis involved an initial scenario-building for the selected commodities, taking into consideration scenario-building for potential impacts of possible interventions on the ecosystem, and on the local economy.

3 Discussion of Research Results

Rice-based Agroecosystem

Cropping Patterns and Agricultural Practices

Rice farmers in Marabut and Basey have two cropping seasons annually; for the first cropping, planting starts from December to January and harvesting is done between March and April, while for the second cropping, planting is usually done between June and July and then harvest from September to October. In between the two cropping seasons, post-harvest management of rice grains (i.e. threshing, drying, milling, etc.) and land preparation for the next cropping are the activities carried out by farmers, although some are also engaged in vegetable farming and fishing. During dry periods, planting seasons are delayed, especially for the rainfed parcels of land, so that, for example, planting for the second cropping starts in August and September and the harvest is in November and December.

In terms of cropping pattern, rice-based agroecosystems in both municipalities traditionally practiced transplanting which followed the random method, where seedlings which were initially grown in nurseries were transplanted without a definite distance or space between plants. However, this method needs planting guides which can be wire, twine or wood, set in the field before transplanting in order to have uniform spacing. Field assessment found an average planting distance of around 20 cm x 20 cm, with 6 cm x 6 cm in Basey while 8 cm x 8 cm in Marabut as the closest, and 42 cm x 38 cm in Basey and 30 cm x 20 cm in Marabut were recorded as the farthest. The high deviation between planting distances was caused by estimations done during transplanting, although they were presumably following the 10 cm x 10 cm or 15 cm x 15 cm which is typical in the straight row method and which could have further delayed the process and required additional labor. With this planting distance, an average of 27 and 24 hills per 1 sq. m. was observed in Basey and Marabut respectively. Plant spacing significantly influenced yield; proper spacing (e.g. 20 to 25 cm) can increase yield by 25% to 40% over improper spacing, as well as saving money on inputs, labour and materials (IRRI, 2007).

Primitive way of manual rice harvesting is still widely applied by vast majority of farmers in Samar who lack equipment (©Caritas Czech Republic/Jakub Zak).

During transplantation of hybrid varieties (e.g. Blonde red rice) only one to two seedlings per hill were planted while the "old local varieties" were planted four to five seedlings per hill. This means that less planting material is needed when hybrid varieties are used by farmers. The number of tillers per hill then varied, ranging from 1 to 27 with an average of 8 tillers per hill, depending on the age, number of surviving seedling and herbivory of the standing crop. By the time of inventory, standing crops were between two and seven weeks after transplanting so they were still in their middle to late vegetative phase characterized by active tillering. This typically happens 40 days after sowing (Ricepedia, undated). It means that the number of tillers was still expected to increase. Transplanted rice normally has 10 to 30 tillers per plant where more space is available between plants, compared to a direct seeded rice field with a normal plant population of 10 to 20 plants per sq

Eight-day-old seedlings of organic rice, Samar (©Caritas Czech Republic/Jakub Zak).

ft having two to five panicle-bearing tillers per plant only (Moldenhauer et al. *undated*).

With regards to varieties used, over 50% of the respondents from both municipalities revealed that they planted the 'blonde red rice' and red rice varieties, seemingly named after the color of the grains, which was reportedly given out by the Social Action Center (SAC) – Calbayog Chapter as relief goods after ST Haiyan. Rice seeds were also given by different stakeholders such as Department of Agriculture-Region VIII, Food and Agriculture Organization (FAO) and the Season-Long Training on System of Rice Intensification (SRI) Program of the Philippines. These are all irrigated lowland cultivars, which are high yielding, early maturing, and disease tolerant and resistant to white heads, green leaf hoppers, brown plant hoppers, yellow stem borer and other pests. These are also known to have good milling recovery and grain quality, as well as, high percentage of acceptability both in cooked and raw forms (IRRI, 2007 and PhilRice, 2011). In Marabut, all the abovementioned varieties were planted either in irrigated paddy rice fields (86%), in which irrigation canals were provided and managed by the National Irrigation Authority (NIA) or rainfed parcels of land (14%).

In Basey, one of the major limitations on the rice production system is water. Majority (61%) of the inventoried farm parcels were rainfed, while the remaining 39% were irrigated (Table 9). Of the 30 farmers interviewed, 82% of them reported that their farms were also rainfed, and only a few respondents (18%) said that their rice fields were irrigated. This has had a significant impact on their rice production system considering they are not able to plant during drought periods. For example longer dry season this year led to the delayed second cropping in which planting reportedly starts in November; meaning that land preparation and seed banking must have been done by the time of the inventory. More than 50% (20 out of 39) of the inventoried plots within Basey were left

Table 9. Cropping patterns of paddy rice-based agroecosystems in Basey and Marabut

Agroecological Characteristics	Study Sites	
	Basey	**Marabut**
Planting method used	Transplanting	Transplanting
Average age of standing crop (weeks)	5	4
Average planting distance (cm)	20 x 20	18 x 19
Average number of hills per sq. m.	24	27
Average number of tillers per hill	9	8
Average number of tillers sq. m.	173	218
Average depth of root zone (cm)	17	24
Percentage of irrigated parcels inventoried (%)	39	86
Percentage of rainfed parcels inventoried (%)	61	14
Percentage of interviewed farmers with irrigated farms (%)	18	86
Percentage of interviewed farmers with rainfed farms (%)	82	14

fallow, allowing the r-strategist, known as opportunistic plant species, to grow and establish while leaving the land in its fallow stage.

In terms of farm inputs inputs, the use of inorganic chemicals such as fertilizers, pesticides and herbicides were still common among Marabut farmers. Fertilizers (e.g. Complete 14-14-14, urea) were usually applied by broadcast method two to three weeks after transplanting or after weeding, which was normally done as soon as the plants became established. Most of the farmers mentioned that they purchased fertilizers from Tacloban City at PhP1,300 per sack or per 50 kilograms, although others bought these from nearby stores or from the neighboring barangays at around PhP35 to PhP40 per kilogram. Reportedly, a few months after ST Haiyan, some farmers were able to buy complete fertilizer in Tacloban City at a much lower price (PhP700 per sack) because these were soaked in water during the super typhoon and they formed aggregates when they were dried. However, these needed more effort to break the aggregates before the farmers could apply the fertilizer. Likewise, Urea is commonly applied upon the onset of the flowering stage and is purchased from Tacloban City for around PhP1,200 to PhP1,300 per sack or PhP35 per kilogram retail in nearby stores. However, many mentioned that they received one or two sacks of urea from DA after the typhoon, enabling them to save some amount for the production of rice. Other farmers also mixed complete fertilizer with urea prior to application.

On the other hand, some rice farmers were already starting to use organic fertilizers and pesticides in rice production. Most of them were already aware of the advantages of using organic inputs. However, some reiterated that information and hands on experience in the production of vermicompost for example, are still needed so that they could adapt the technology. The

Communal gardening gives women associations opportunity to share and gain knowledge while making additional profit for their households (©Caritas Czech Republic/Jakub Zak).

Preparation of raw materials for oriental herbal nutrients (©Caritas Czech Republic/Jakub Zak).

Osmeña and Panan-awan Organic Farmers Association is already convinced that using organic inputs is helpful on farms, based on the evidence of healthy rice growth and thus better yields as well as less production costs. Members of the association are also aware that prices of organic products are higher than prices from high-chemical-input farms. Although they clarified that the priority of the association are the members of the group and it set aside seedlings for the next cropping season. Among the organic inputs they used are organic fertilizers which are composed of 90 kilograms vermicompost mixed with 5 sacks of rice hull. Trainers on vermicompost processing and production were from the Farm Resource Management Institute of the Visayas State University. Rice straws were also scattered and allowed to decompose within the parcels of land while others were taken by members of the Women's Association for vermiculture. Training on the production of organic inputs such as vermicompost was also started by the Tag-alag Fisherfolks and Farmers Association.

Other reported associate species which have influenced rice production are pests, including green leaf hoppers, locally called *tiyangaw*, which attack the growing plants specifically during the milk stage, when the developing starch grains in the kernel are soft and the interior is filled with white liquid resembling milk. This is one of the most critical stages of rice growth and development because without prior pest control and management, yield could decline significantly. Other common pests are stem borers and black bugs. Golden snail, locally known as *kuhol* is also another major problem for rice farmers in Samar. Controlling the golden snail is done either by manual picking or through the application of a snail gun. One farmer shared the information that instead of picking up each snail manually and throwing them into dry areas, he made a water pool on the side of his parcel of land to gather the snails and he then sprayed them. This is to maximize the impact of the pesticide while minimizing the volume of chemical used, and at the same time restricting the chemical application to a much smaller area.

For the labour costs, many farmers hire labourers for the different activities on the farm, from land preparation to harvest; others hire labourers for drying the rice grains. For land preparation, all of them reported that they pay PhP100 per hour for the land master plus food for the operator; meaning the total amount varies depending on the size of the farm. A 0.5 ha rice farm for example, would cost PhP1,000. For transplanting, weeding, harvesting and threshing, most of them hired labourers for PhP250 per day exclusive of meals; otherwise PhP200 was paid per day plus two meals and two snacks. Many of the farmers also utilize family labour especially for weeding, in order to minimize production costs. All the respondents reported that payment for threshing of rice to the thresher owner was 10% of the harvested palay and could be done in kind; meaning that for every 10 sacks of palay, 9 were for the farmer while the tenth was for the thresher owner. For the irrigated parcels of land, an additional cost was spent for the payment of irrigation services provided by NIA at PhP1,200 per hectare after every harvest. In kind payment for irrigation services was reportedly possible at 4 sacks of palay per hectare of rice field, with each sack weighing around 35 kilograms and equivalent to PhP350, amounting to PhP1,400 per hectare in total. The milling of palay costs PhP40 or 2 kilograms per can of rice (weighing approximately 17 kilograms) plus transportation costs.

Most harvests were for family consumption and particularly those farming an area of less than one hectare. Tenants are giving 1 out of every 5 sacks of palay to the land owner, so only 4 sacks are left to the tenant. A farmer in San Roque, who usually harvests 15 sacks per cropping, gives 2 sacks to each of his 2 married children, leaving only 9 sacks.

Species Composition, Distribution and Diversity

Rice is one of the major cultivated crops and is consumed as a staple food by the residents in Samar making it a very important crop as it is in all other parts of the country and in Southeast Asia. The rice-based agroecosystems in Basey and Marabut were found to be associated with different species, listing a total of 32 plant species encountered across sampling sites, four of which categorized as cultivated while the remaining species were associates. In Basey, a total of 25 species belonging to 12 families in 20 genera were listed, two species of which were cultivated species while the other 23 were present as associates. On the other hand, Marabut had 14 plant species in total, with four considered as cultivated and belonging to four genera under three families while 10 species belonging to 10 genera under eight families were categorized as associates (Tables 10 and 11). Two of the cultivated species were common to both sites including rice and a vegetable locally known as 'kangkong' (*Ipomea aquatica*) while *Cymbopogon citratus* (DC) Stapf. (Poaceae) was only found in Marabut (Table 10). *Kangkong* is a tolerated species within rice-based agroecosystems and it is used as vegetable with the young tops or plants (stem and leaves) cooked or lightly fried in oil and eaten in various dishes. This is the reason why farmers allowed the plant to grow

Table 10. List of cultivated species encountered in paddy rice-based agroecosystems in Basey and Marabut

Family Name	Genus	Specific epithet	Author	Common/ Local Name	Municipalities	
					Basey	Marabut
Bromeliaceae	*Ananas*	*comosus*	(L.) Merr.	Pinya	-	•
Convulvolaceae	*Ipomea*	*aquatica*	Forssk.	kangkong/ Water spinach	•	•
Poaceae	*Oryza*	*sativa*	L.	Rice	•	•
Poaceae	*Cymbopogon*	*citratus*	(DC) Stapf, Kew Bull.	Tanglad	-	•
Total Number of Families					2	3
Total Number of Genus					2	4
Total Number of Species					2	4

Table 11. List of species encountered in paddy rice-based agroecosystems in Marabut

Family Name	Genus	Specific	Common/ Local epithet	Municipalities Name	
				Basey	Marabut
Amaranthaceae	*Amaranthus*	*spinosus*	Amaranth	-	•
Asteraceae	*Mikania*	*cordata*	Vietnam/ Asyang	-	•
Byttneriaceae	*Melochia*	*concatenata*	Bankalan	•	-
Cleomaceae	*Cleome*	*rutidosperma*	Silisilihan	-	•
Commelinaceae	*Commelina*	*diffusa*	Climbing dayflower	•	•
Convolvulaceae	*Ipomoea*	*triloba*	Aiea morning glory	•	-
Cyperaceae	*Fimbristylis*	*miliacea*	Hoorahgrass/ Bungot- bungot	•	•
Cyperaceae	*Actinoscirpus*	*grossus*	Giant bur rush	•	-
Cyperaceae	*Cyperus*	*strigosus*	False nutsedge	•	
Cyperaceae	*Cyperus*	*difformis*	Ubod-ubod	-	•
Cyperaceae	*Bolboschoenus*	*planiculmis*	Apulid	-	•
Lamiaceae	*Hyptis*	*capitata*	Turukan	•	-
Lamiaceae	*Hyptis*	*brevipes*	Lesser roundweed/ Pansi- pansi	•	-
Lindernaceae	*Lindernia*	*procumbens*	False pimpernel	•	-
Mimusaceae	*Mimusa*	*pudica*	Makahiya	•	•
Onagraceae	*Ludwigia*	*octovalvis*	Willow primrose	•	-
Passifloraceae	*Passiflora*	*foetida*	Stinking passion flower	•	-
Phyllanthaceae	*Phyllanthus*	*amarus*	Talikod	•	-
Poaceae	*Paspalidium*	*flavidum*	Lisang kalabaw	•	-
Poaceae	*Paspalum*	*filiculme*	Pagetpet	•	-
Poaceae	*Paspalum*	*distichum*	Knotgrass	•	-
Poaceae	*Paspalum*	*dilatatum*	Dallisgrass	•	-
Poaceae	*Paspalum*	*conjugatum*	Carabao grass/ Lakatan	•	•
Poaceae	*Echinochloa*	*colona*	Jungle rice	•	•
Poaceae	*Echinochloa*	*crus-galli*	Common barnyard grass	•	-
Poaceae	*Ischaemum*	*rugosum*	Wrinkle duck beak	•	-
Poaceae	*Setaria*	*sp.*	Wild Foxtail millet	•	-
Rubiaceae	*Oldenlandia*	*corymbosa*	Malaulasiman	•	-
Total Number of Families				10	8
Total Number of Genus				19	10
Total Number of Species				23	10

alongside with rice. Some also use the vines as fodder for pigs. Lemon grass, recorded in Marabut, is often used as an ingredient in local dishes, especially soups. It also goes well with seafood, beef, and poultry. *Tanglad* is also rich in vitamin A so it is commonly used as a tea. Although these were the only cultivated and tolerated species found within plots in rice-based agroecosystems, coconut was mostly found along or nearby the sampled parcels of land. This record corroborates Moody's study (1989) which listed the same species in an inventory of spontaneous and cultivated vegetation occurring in upland rice in South and Southeast Asia. Other species observed being planted in the rice paddies include pineapple. All of these cultivated species planted or tolerated together with rice are reported as sources of food and condiments or as having medicinal value.

In the municipality of Marabut, a handful of associated species was recorded, with *Cyperaceae* mostly represented by three species, followed by *Poaceae* with two species and the other five families with one representative species each (Table 11). For Basey, family *Poaceae* was mostly represented by a total of nine species, four of which are under the genus *Paspalum*, two under *Echinochloa* and one each for the genii *Paspalidium, Ischaemum* and *Setaria*. Family *Cyperaceae* followed after *Poaceae* and was represented by three species, each belonging to three different genera. The higher number of associated species in Basey is due to the large areas of fallow fields so that weed proliferation was highly evident, unlike in Marabut where fields were still tilled and planted and weeding, as well as the application of herbicides, was employed. This record is consistent with the study conducted by Galinato, *et al.* (1999) on Upland Rice Weeds of South and Southeast Asia, with the families recorded in their study also constituting the mostly represented rice weed families.

Among the associated species recorded on both sites, some are listed under the "world's worst weed" category by Caton et al. (2010). These species include *Amaranthaceae* and *Poaceae* which are noxious weeds and when their numbers are not controlled they have very harmful effects on the status of rice plants. Being prolific seeders, they can cause economic losses when their population reaches 10 plants per sq m and heavy infestations can choke the rice plants, resulting in yield loss of 5 tons per ha (NSW DPI, 2013). Furthermore, resistance to herbicides and responsiveness to nutrients (N, P, K) are also reported in the two species of *Echinochloa*, while *Amaranthus* serves as a potential host for root knot nematodes, insect pests and different viruses that cause tobacco mosaic virus and groundnut rosette (Galinato *et al.*, 1999 and NSW DPI, 2013). Cultural management practices employed to control this species include early cultivation, thorough land preparation, flooding, hand weeding and crop rotation.

Land preparation for gardening (©Caritas Czech Republic/Jakub Zak).

Associated species that are common to both sites are very persistent and prolific in fields and competes with rice for basic needs such as light, space, water and nutrients. They are generally regarded as forage and cover species (Galinato et al., 1999 and Caton *et al., 2010*). This explains the highest relative frequency (29% and 31%) and the highest relative density (2.1% and 1.8%) of *C. diffusa* in Basey and Marabut respectively (Figure 6-9). Controlling this by hand weeding necessitates uprooting the entire plant to ensure effectiveness. *Tiriguhan* is identified as one of the most important weeds of upland rice under moist conditions. It is adapted to full sunlight or partial shade and grows in loam, silt and clay soils under drained, low lying grasslands, in farmlands, and in both dry and marshy conditions. Its tillers outgrow most rice cultivars, offering stiff competition for light and nutrients. This could be

Table 12. Relative frequency, relative density and the potential uses of the top associated species in the rice-based agroecosystems in Basey and Marabut

Local/Common Name	Scientific Name	Relative Frequency (%)		Relative Density (%)		Local/Potential Uses
		Basey	Marabut	Basey	Marabut	
Bankalan	*Melochia concatenata*	33.3	-	1.3	-	Used to relieve headache
Tari-tari	*Commelina diffusa*	29.2	31.3	2.1	1.8	For external wound bleeding
Malaulasiman	*Oldenlandia corymbosa*	25.0	-	1.0	-	Decoction used for fever and stomachache
Bungot-bungot	*Fimbristylis miliacea*	20.8	12.5	1.0	1.3	Forage for cattle
Lesser roundweed	*Hyptis brevipes*	20.8	-	0.2	-	No known uses
Turukan	*Hyptis capitata*	16.7	-	6.1	-	No known uses
False pimpernel	*Lindernia procumbens*	16.7	-	0.3	-	Treatment of diabetes
Willow primrose	*Ludwigia octovalvis*	16.7	-	0.4	-	Treatment of diarrhea
Carabao grass	*Paspalum conjugatum*	12.5	12.5	3.1	0.3	Forage for animals (e.g. carabao)
Common barnyard sores	*Echinochloa crus-galli* grass	12.5	-	0.5	-	Folk remedies for wounds,
Wrinkle duck beak	*Ischaemum rugosum*	12.5	-	0.4	-	No known uses
Wild Foxtail millet	*Setaria sp.*	12.5	-	1.4	-	Feed for animals
Makahiya	*Mimosa pudica*	8.3	18.8	0.3	0.5	Roots used as diuretic and dysmenorrhea
Tiriguhan	*Echinochloa colona*	8.3	6.3	0.6	0.1	Animal feed, fodder, forage
Giant bur rush	*Actinoscirpus grossus*	8.3	-	0.3	-	Stems used for making mats and bags
Dallisgrass	*Paspalum dilatatum*	8.3	-	0.7	-	Forage for animals (e.g. carabao)
Knotgrass	*Paspalum distichum*	8.3	-	0.7	-	Forage for animals (e.g. carabao)
Vietnam	*Mikania cordata*	4.2	18.8	0.1	1.3	Medicine for wounds

controlled by cultivation during its early growth and can be controlled by hand and hoe. *Bungot-bungot* is also reported to have allelopathic effects on some rice varieties and also tends to affect physiological processes (Siddique and Ismail, 2013 and Begum *et al., 2009*). Locally, these species are utilized as forage for animals (Table 12).

Paspalum and *Mimosa*, on the other hand, are two common weeds in rice paddies as these species prefer sunny, open and moist to wet areas. *Paspalum* is occasionally used as a lawn grass and as forage for grazing or in cut-and-carry systems (Galinato *et al., 1999*). Its reproduction is highly vegetative, especially when machines are employed during tillage because the percent of seed germination for this species is usually low. However, for *Mimosa*, propagation is only by seeds (675 seeds / plant), which can remain viable for long periods (19 yrs. still with 2% germination). Common factors affecting these species are their susceptibility to host to several rice pests and diseases such as rust fungi, rice sheath blight, and bacterial blight. Suggested management strategies to control their population include manual weeding, flooding and the application of various herbicides that suit the species' biology, and determining resistant rice varieties for planting.

Of the remaining species for both Basey and Marabut, they are all included under families that are also known to be associated with both paddy and fallow rice fields. Though for Basey, it was found that *Bankalan* was the dominant species. It was also the species that occurred most frequently (relative frequency = 33%) and was one of the most dense (relative density = 1.3%) among the associated species growing on fallow fields. It is also reportedly used to relieve headaches. In frequency this was followed by the two species under *Rubiaceae* and another two species of *Hyptis* (Table 12, Figures 6 and 7). This could be mostly attributed to the fact that this species prefer rainfed lowland rice and other dryland crops and this was the characteristic setting for the Basey fields. Furthermore, the main flowering time was consistent with the sampling months, which were from September to October and maximum growth and proliferation was observed during site visits. The species is very well-adapted and ensures a huge seed bank of 6,000 seeds per plant with a wide germination temperature requirement

Figure 6. *Relative frequency (%) of species in the rice-based agroecosystem in Basey*

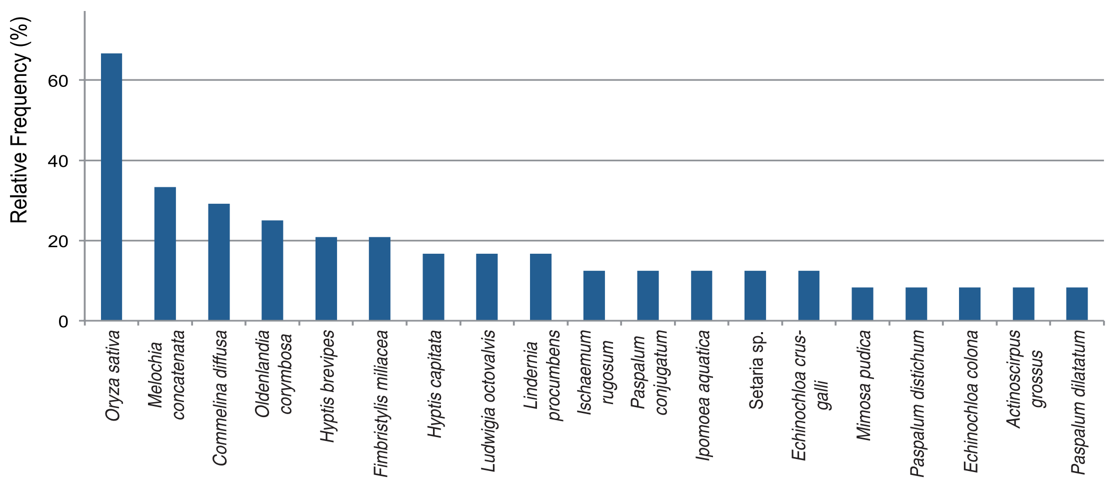


Figure 7. *Relative frequency of species associated with the rice-based agroecosystem in Marabut*

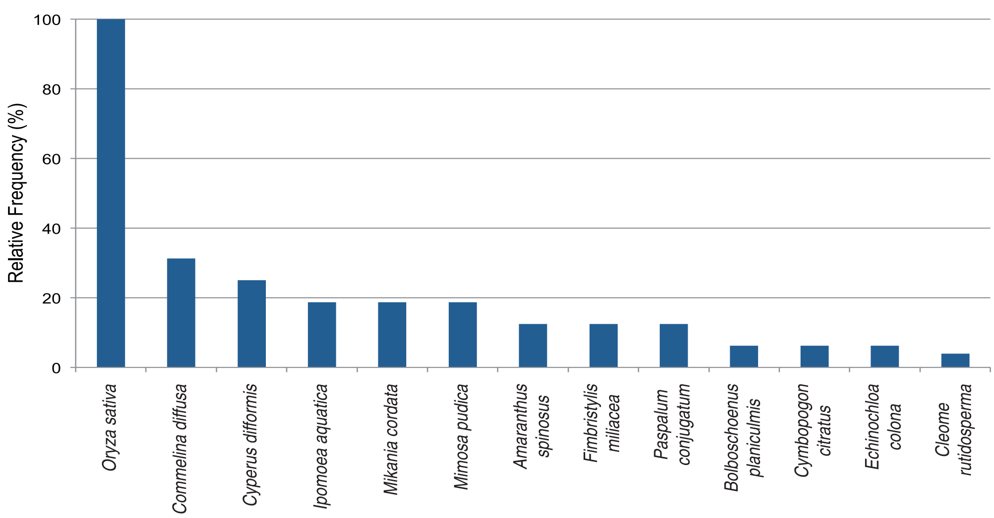
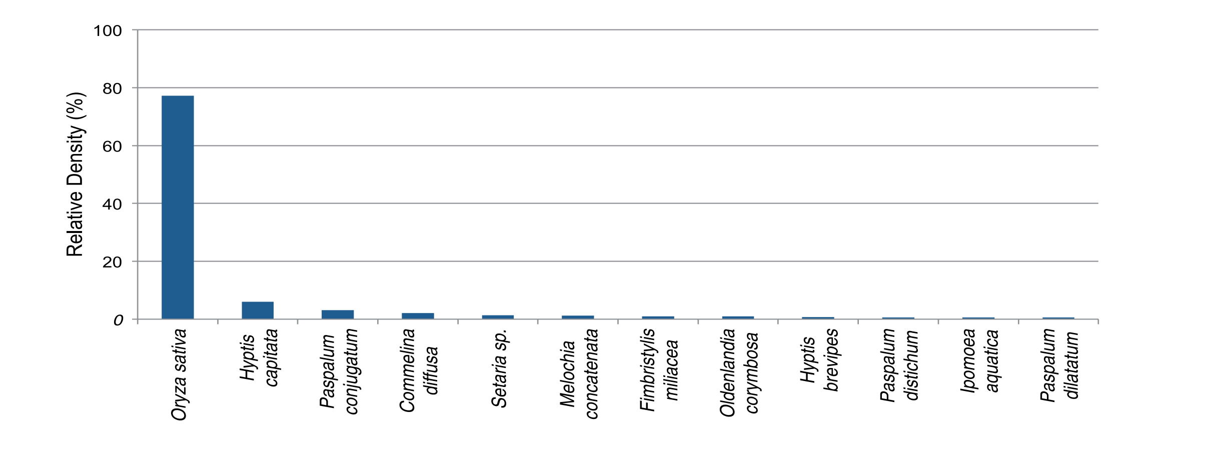


Figure 8. *Relative density (%) of top species in the rice-based agroecosystem in Basey*



ranging from 20-40°C. *Bankalan* is an alternate host for nematodes (*Pratylenchus* and *Rotylenchus*) and can be controlled by the chemical application of herbicides such as 2,4-D or MCPA (Galinato, *et al.*, 1999).

A survey of rice fields in tropical Asia determined that weeds were the most significant pest factor in reducing yields by 23% due to weeds growing above the rice canopy and by 21% due to weeds growing below the rice canopy (*Gianessi*, *2014*). Rice farmers in Samar are also aware of the yield losses these weeds could cause and so they control them with a chemical herbicide (known as 2, 4-D) which is used in many products to control weeds, and is often mixed with other herbicides. This herbicide kills broadleaf weeds, but not most grasses, by causing the cells in the tissues that carry water and nutrients to divide and grow without stopping (NPIC, 2009). Other farmers, however, still practice the traditional method for weed control in Asian rice fields, which is hand weeding by utilizing family labour, including children during weekends and on non-school days. On the other hand, some farmers are already convinced of the advantages of using organic and biological pest control methods so they manufactured their own 'organic pesticides' which were basically composed of plants. For example, the mixture of 'tubli' roots, chili and *panyawan* was fermented and then bonux powder was added. It is a brand of soap detergent and was used as a pesticide against green leaf hoppers (*tiyangaw*). Another 'organic pesticide' is made from the fermented leaves of *bagongbong*, *mahogany* and *kakawate* with the addition of bonux powder. Some also used garlic, onion and oil. Sea water or freshwater with salt was then added to the mixture. The use of mechanical weeders was practiced by the Osmeña and Panan-awan Organic Farmers Association.

Species diversity is one of the components of the concept of biodiversity which measures the diversity within an ecological community taking into consideration species richness, the number of species in a community,

Slicing ginger for the production of oriental herbal nutrients
(©Caritas Czech Republic/Jakub Zak).

Figure 9. *Relative density of species associated with the rice-based agroecosystem in Marabut*

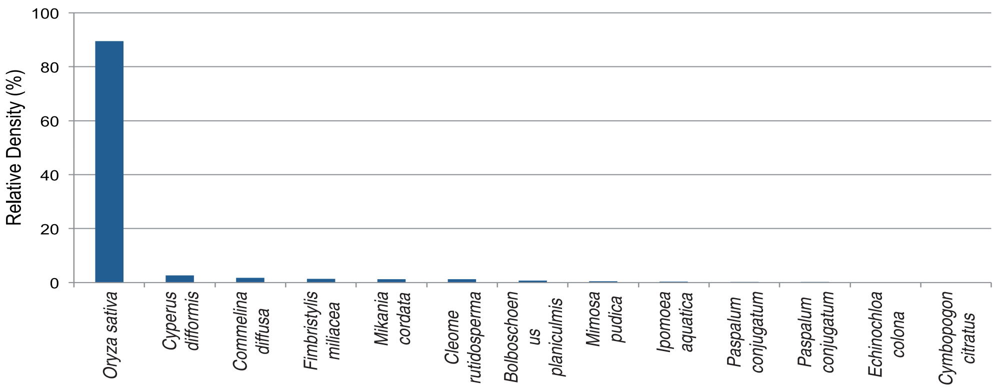
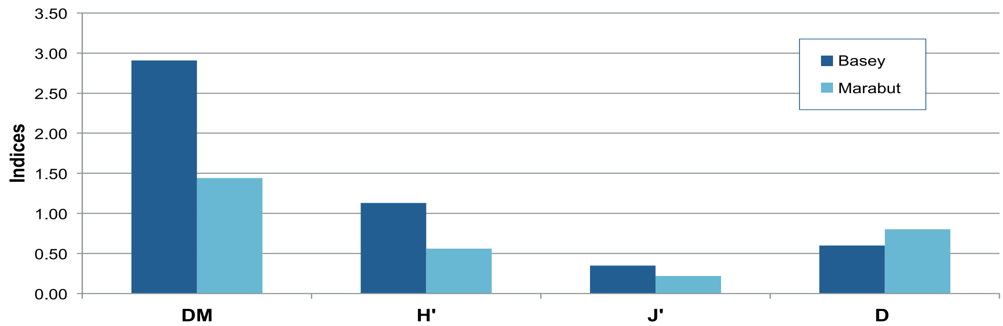


Figure 10. *Margalef's species richness (DM), density index (H'), evenness (J') and dominance (D) of species in the rice-based agroecosystems in Basey and Marabut*



and the even spread of species, a measures of the variation in the abundance of individuals per species within a community (McGinley, 2014). A community dominated by one or two species is considered less diverse than one in which several different species have a similar abundance so that as species richness and evenness increases, diversity also increases.

As shown in Figure 8, of all the species recorded in Basey, rice (*Oryza sativa*) had the highest relative density (77%). The remaining species were present in relatively much lower numbers (rel. density $\leq$ 6%) while in Marabut, rice has a relative density of 89% and its associates were recorded to have a relative density of $\leq$ 2% (Figure 9). The clear difference especially in the relative density of the species clearly affected species diversity of the ecosystem.

Results show that between the two sites, the rice-based agroecosystem in Basey is more diverse than Marabut (Figure 10). This could be explained by the lower dominance index and the higher evenness index compared to Mara but. In addition, species richness in Marabut is almost 50% less than in Basey, contributing mainly to the very low species diversity index obtained in Marabut. However, the higher species richness index in Basey is largely due to the presence of the high number of associated species, including those considered to be weeds which have no known uses up to this time (e.g. lesser roundweed, turukan). They have very effective forms of reproduction

Table 13. Average planting distance per species of pinakbet vegetable-based agroecosystems in Basey and Marabut

Local Name	Scientific Name	Planting Distance (cm)	
		Basey	Marabut
Okra	*Abelmoschus esculentus*	80 x 79	87 x 86
Kalabasa/Karubasa	*Cucurbita maxima*	152 x 205	232 x 660
Amplaya/Mariguso	*Momordica charantia*	124 x 138	72 x 79
Talong/Tarong	*Solanum melongena*	92 x 83	64 x 62
Balatong/Hantak	*Vigna unguiculata*	79 x 76	38 x 71

and germination in fallow parcels of land, hence management efforts are not carried out until such time that sufficient water is available for cropping. Nevertheless, the lower species diversity observed in Marabut rice fields is caused by the dominance of rice in all parcels of land over the associated species because of the removal of weeds and the application of herbicides to minimize competition for nutrients, light, water and other available resources required for the growth and development of rice.

An additional factor contributing to high species richness and thus increased species diversity is the presence of swamps in Basey which are alleged to be peatland due to high organic matter content as evident by the dark brown to black colour of water. These areas, which are reportedly submerged with water throughout the year and even during dry periods, were dominated by barnyard grass and *bankalan* during the fallow periods. They are also planted with rice during cropping seasons, however, farmers were finding these areas difficult to cultivate due to a much deeper and softer paddy layer. According to one of the farmers, a certain part of the swamp was previously cultivated and planted with rice but cultivation was eventually stopped after some cropping because of poor rice yield due to an unknown disease manifested by the blackening of the young grains, seemingly caused by poor nutrient content in the peat soil.

Vegetable-based Agroecosystem

Cropping Patterns and Agricultural Practices

Vegetable-based agrosystems in Samar were found to be small-scale and basically used for household consumption only. These were variable in size, ranging from thin strips along or climbing on house fences to backyard gardens. Others were also found in small plots of lands located a few metres away from people's houses. Seeds (e.g. brand East West) were reportedly given by DA, Caritas Germany, Calbayog (CDA), Red Cross, PLAN International, Food and Agriculture Organization (FAO) and other organizations, as part of the emergency relief after the supertyphoon Haiyan. A few, however, reported that they bought seeds from Tacloban City because they only received one pack from the relief supply.

Based on the rapid agroecological assessment conducted vegetable gardens in Basey and Marabut followed different planting distances, depending on the species and on the cropping patterns. For example squash, a creeping vegetable was planted at an average planting distance of 1.5 m x 2.0 m in Basey, while in Marabut the planting distance was more than double with 2.3 m x 6.6 m (Table 13). However, common practices in the gardens inventoried were intercropping and mixed cropping, which explains the various planting distances followed. *Okra* was mostly found planted either on strips of land along house fences or as hedgerows between plots. This was reportedly done to avoid shading which could have negative effects on other vegetable species. *Ampalaya* was planted at a far greater distance (1.2 m x 1.4 m) in Basey than in Marabut (0.7 m x 0.8 m), while for *talong* a difference of 20-30 cm in planting distance was found between the two sites. The differences in planting distance among species are designed to minimize competition and other negative interactions. Another factor causing differences in planting distance, especially for creeping vegetables (such as *Kalabasa*, *Amplaya* and *Balatong*), was the cropping technique, in which some were left

Preparation of organic pesticide (©Caritas Czech Republic/Jakub Zak).

to spread along the ground while others were provided with anchorage structures so that their fruit was hanging rather than touching the ground.

Agricultural inputs were also provided to ensure good harvest from vegetable-based agroecosystem. These include fertilizers, usually urea, which was part of the relief from DA, and vermicompost from PLAN International, which was placed in the holes when seeds were transplanted. A number of the respondents also reported that they used complete fertilizer (14-14-14), which is applied twice through basal application, first during planting and then before flowering. Although some said that they apply fertilizer once a month, guano, which is gathered from nearby caves, is also used by vegetable growers and is placed in the holes during transplanting or during seed germination. Others also reported that they used chicken manure and decomposing rice straws, while a few mentioned that they used organic fertilizer, which they produced themselves. Common insect pests are present, such as borers, white and black aphids, worms, fruitflies and others; therefore controlling them is necessary. Pesticides such as Symbos 5, Malathion 57 E.C., Karate and padan powder were among the commonly used pesticides and insecticides. On the other hand, some garden owners revealed that instead of using inorganic chemicals, they burn dried leaves and twigs to produce smoke that would keep away insect pests that may otherwise damage the vegetables. Other farmers, knowing that they are the primary consumers of their produce, manually remove worms and infected leaves to avoid using chemicals which could damage their bodies. Others also trap insect pests by setting up electric lamps in their gardens at night with a bucket of water below the lamps to drown the insects. Hand weeding to control weeds was also common among vegetable growers.

Table 14. Relative frequency, relative density and the potential uses of the top cultivated species in the vegetable-based agroecosystems in Basey and Marabut

Scientific Name	Common Name	Relative Frequency (%)		Relative Density (%)		Potential Uses
CULTIVATED		Basey	Marabut	Basey	Marabut	
Solanum melongena	Talong/eggplant	73.91	80.00	23.20	12.93	Food, Wound treatment
Colocasia esculenta	Gabi	65.22	64.00	20.25	12.90	Food
Cymbopogon citratus	Lemongrass/ Tanglad	56.52	40.00	0.69	0.99	Hypertension remedy, Seasoning
Capsicum annuum	Atsal	52.17	24.00	1.22	0.70	Spices
Ipomoea batatas	Kamote	43.48	24.00	1.52	3.33	Food
Abelmoschus esculentus	Okra	39.13	56.00	8.43	7.19	Food, herbal medicine
Ipomoea aquatica	Kangkong	34.78	24.00	0.60	0.86	Food
Curcuma domestica	Turmeric/Duraw	34.78	28.00	0.66	0.38	Spices
Cocos nucifera	Coconut	34.78	36.00	0.91	0.53	Food, oil, timber
Cucurbita maxima	Kalabasa/squash	34.78	48.00	7.76	3.48	Food
Artocarpus heterophyllus	Langka	30.43	4.00	0.16	0.04	Food, Pesticide
Carica papaya	Papaya	30.43	24.00	0.24	0.25	Food
Psidium guajava	Bayabas	26.09	36.00	0.17	0.70	Food, herbal medicine
Momordica charantia	Mariguso/ Ampalaya	26.06	48.00	3.36	4.74	Food

In terms of intensity and purpose, the growing of vegetables was usually at the level of subsistence farming. In so much as most of the respondents reported that produce from their gardens was for household consumption only. Some reported that they sell some produce within their barangays by taking it around the area. Some of their neighbours also come to their houses to buy vegetables, at a much lower price relative to the market price, and in some cases they give vegetables away. For example, eggplant was sold at PhP20/kg or per 15 to 18 pieces; squash was sold at PhP20 to PhP30 per piece, depending on size, okra was sold at less than PhP1.00 per piece, and bitter gourd at PhP40 per kilogram.

Species Composition, Distribution and Diversity in Vegetable-based Agroecosystem

In vegetable-based agroecosystems, a total of 205 species in 178 genera and 104 families have been encountered. In Basey, a total of 109 plant species under 96 genera and 54 families have been recorded, and of those cultivated plant species account for 56 species under 48 genera and 33 families (Appendix Table 25). For the species under the Cucurbitaceae family, immature fruits are totally edible, either cooked or raw. However, they cannot be stored after being picked because they have soft rind and seeds that will not germinate once harvested (Dittmar and Stall, 2012). The plant species were mostly planted in backyard gardens, while some are situated in larger areas away from the owners' homes, and serve as garden plots where vegetables are grown under different cropping systems (intercropping, monoculture etc.).

In both municipalities, eggplant was the most frequently found (74% in Basey while 80% in Marabut) occurring at a highest density of 23% and 13% in Basey and Marabut respectively. Aside from being a vegetable crop, it is also used to treat wound by the people in Samar. Aside from "pinakbet vegetables" 'gabi' was also found common. It is because its corm is eaten as staple food in substitute with rice whiles its leaves or dish petiole is vegetables (Table 14).

For the associated species in the vegetable-based agroecosystem in Basey, a total of 53 identified species in 96 genera and 54 families were recorded. The huge number of *Asteraceae* is attributed to the characteristic that these species are one of the largest plant families (UNLV, undated). This family also includes some of the common weeds found in gardens and cultivated areas, which can grow in varied climates, soil types and elevations. However, the presence of all these species associated with a vegetable agroecosystem poses a serious threat, especially if the species' time of emergence is prior or simultaneous to that of the vegetable crop (Dittmar and Stall, 2012). In this respect, proper management strategy that will ensure that crop has a competitive advantage is of great importance in order to prevent yield loss. To this end, different conventional methods can be employed, these include: mechanical control, mulching and use of herbicides. These weed species can also be host to various insect pests and diseases which could cause serious damage, especially under a monoculture system which is the usual practice in most of the sampled sites.

There are 96 plant species under 82 genera and 50 families documented in the municipality of Marabut. Fifty- six species under 48 genera and 33 families

Figure 11 *Relative frequency (%) of associated species in the vegetable-based agroecosystems in Basey and Marabut*

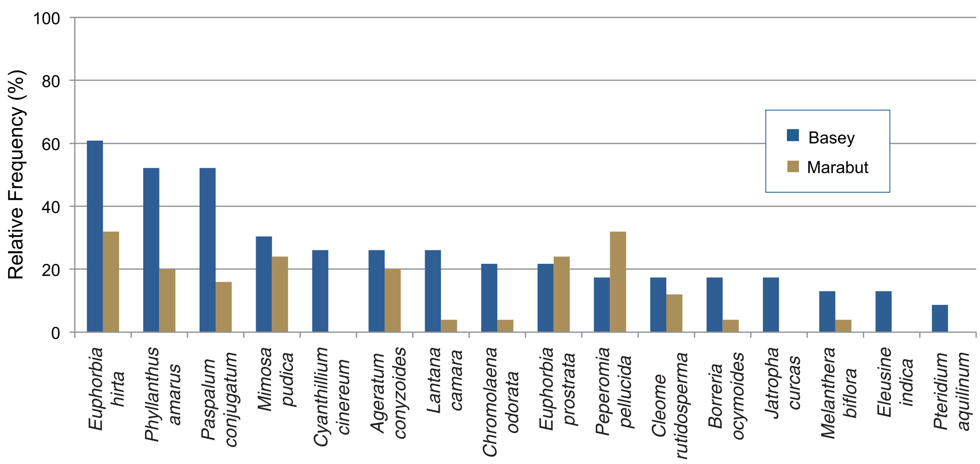
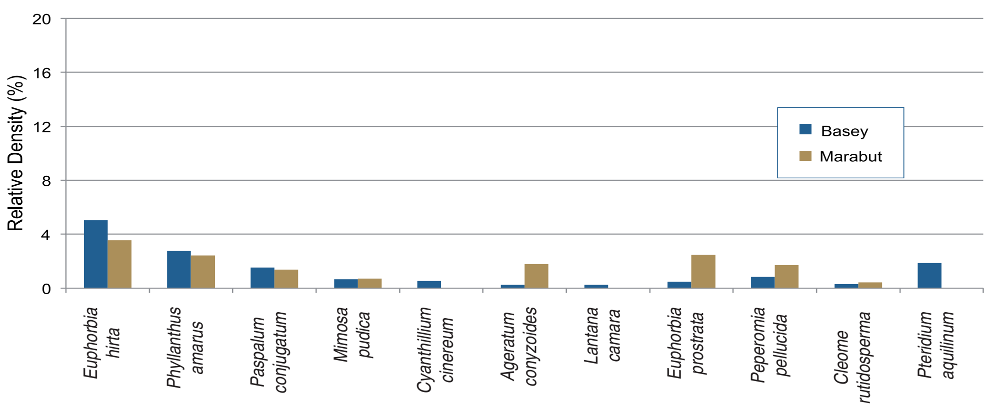


Figure 12. *Relative density (%) of associated species in the vegetable-based agroecosystems in Basey and Marabut*



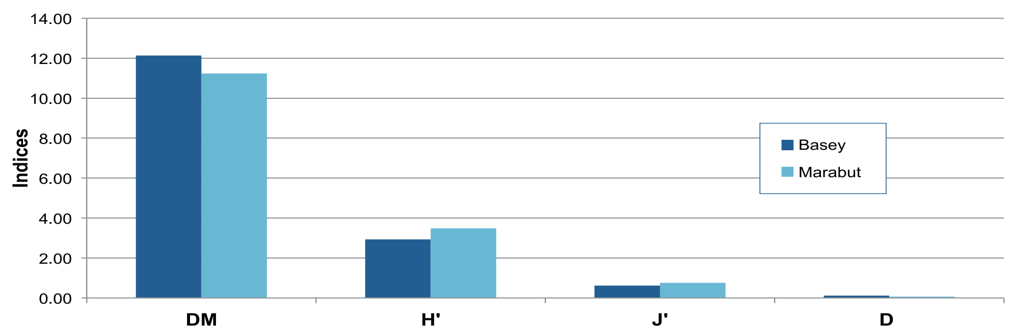
comprise the cultivated species, while the rest of the 53 species under 48 genera and 21 families were recorded under the associated species category (Appendix Tables 27 and 28). *Fabaceae* is the most represented family of cultivated species on this site, with five identified species. The number of species representing these families account for commonly cultivated "pinakbet vegetables" as mentioned earlier for Basey. For Marabut, the family *Fabaceae* was the most represented because of additional planted species (greenbeans, Chicharo, Sigarilyas). These species were said to be cultivated mostly for personal consumption, although others sell some of their harvest to local stores and sometimes to interested local buyers. The practice of backyard gardening was observed as the most common method of growing vegetables as this provides easier monitoring, management and access to the crops. However, a few people farmed larger areas far from their homes for the purpose of producing more yield.

A larger number of associated species was recorded in Marabut compared to Basey (53 species under 48 genera and 21 families were identified). Of these, 10 species represent the family *Poaceae*, which makes it the most represented family. This was followed by *Asteraceae* with seven species, *Cyperaceae* with five and the rest had one to three species identified. Species under *Poaceae* and *Cyperaceae* families have unique adaptive features that make them suitable for conditions on the vegetable farms. They are prolific- seeders and at the same time can grow via vegetative propagation of modified stem and roots. Some also have an allelopathic effect on other crops which gives them a competitive advantage during periods of proliferative growth. As they are considered to be one of the pioneer species in ecological succession,

Table 15. Relative frequency, relative density and the potential uses of the top associated species in the vegetable-based agroecosystems in Basey and Marabut

Scientific Name	Common Name	Relative Frequency (%)		Relative Density (%)		Potential Uses
ASSOCIATED		Basey	Marabut	Basey	Marabut	
Euphorbia hirta	Tawa- tawa	60.87	32.00	5.04	3.54	Medicine against dengue
Phyllanthus amarus	Sampasampalukan	52.17	20.00	2.75	2.42	
Paspalum conjugatum	Carabao grass	52.17	16.00	1.52	1.37	Fodder
Mimosa pudica	Makahiya	30.43	24.00	0.66	0.72	Anti-hemorrhoids
Cyanthillium cinereum	Tagulinao	26.09	-	0.54	-	Medicine
Ageratum conyzoides	Goatweed	26.09	20.00	0.24	1.79	Insecticide, Nematicide
Lantana camara	Lantana	26.09	4.00	0.24	0.06	Ornamental, Gargle for toothaches
Chromolaena odorata	Hagonoy	21.74	4.00	0.21	0.04	Fodder, Ornamental
Euphorbia prostrata	Kaliskis	21.74	24.00	0.49	2.49	Remedy from bleeding hemorrhoids
Peperomia pellucida	Sinaw- sinaw	17.39	32.00	0.84	1.71	Medicine for Gout, Arthritis, Fever
Cleome rutidosperma	Silisilihan	17.39	12.00	0.30	0.44	Food, Deafness remedy
Borreria ocymoides	Siksik parang	17.39	4.00	0.16	0.32	Anti- ulcer
Jatropha curcas	Tuba- tuba	17.39	-	0.12	-	Biofuel
Melanthera biflora	Beach sunflower	13.04	4.00	0.25	0.02	Ornamental
Eleusine indica	Padpad	13.04	-	0.09		
Pteridium aquilinum	Pako	8.7	-	1.87	-	Food

Figure 13. *Margalef's species richness (DM), diversity index (H'), evenness index (J') and dominance (D) of species in the vegetable-based agroecosystems in Basey and Marabut, Samar*



the availability of open spaces, such as during land tilling in preparation for planting, results in empty areas which grasses and weeds can immediately occupy. This is one of nature's healing mechanisms to prevent too much exposure of the soil surface to extreme temperatures and abiotic stresses (weathering, erosion, leaching, etc.) which alter its physical and chemical properties. Thus, there is a trade off between the ecological functions of these associated species and the need to eliminate them during the vegetable growing season. Therefore, proper farm management needs to be employed which will reduce, if not eliminate, the damage caused by these "unwanted" species, while at the same time ensuring the sustainability of the soil and the environment in order to support the next cropping season.

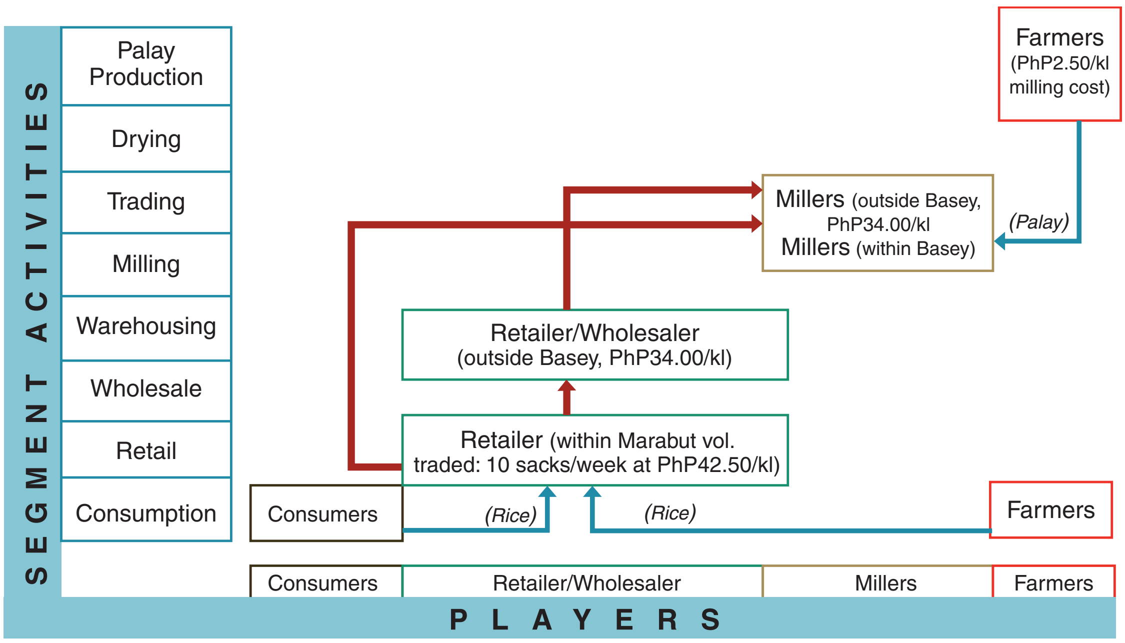
Of all the associates locally known *tawa-tawa* was found most frequent (relative frequency = 61% and 32% for Basey and Marabut) and with highest relative density among all the associates with a relative density of 5% (Basey) and 3.5% (Marabut). This species is allowed in gardens because the locals are using the plant as herbal medicine in treating dengue fever (Tables 14 and 15). This was followed by *Sampasampalukan, Carabao grass* and other species which commonly function as food for animals. Others can be used as an environmental indicator (*Hagonoy*) in which presence indicates phosphorus deficiency in the soil. Some of the top associated species have potential medicinal uses (such as *Tagulinao, Makahiya, Sinaw-sinaw, Silisilihan, Siksik parang*).

Relative to the rice-based agroecosystem, the vegetable-based agroecosystem in Samar is more diversified as evidenced by the numerous species listed at both sites (Figure 13). Between the two sites, vegetable gardens in Basey had more species (109) than Marabut (96). However, the latter was found to be more diverse (H' = 3.49) than the former (H' = 2.93). This could be explained by the higher evenness index in Marabut (J' = 0.76) than Basey (J' = 0.62) which means that the species encountered in Marabut were almost fairly evently balanced in terms of abundance resulting in a lower dominance index of D = 0.06 compared to that of Basey with D = 0.12. Although more species were listed in Basey than in Marabut (Appendix Tables 29 and 30), many gardens were found to be dominated by certain species. For example, a total of 33 species with 695 individuals were listed from a 1,800 sq m garden in Basey of which 210 hills were eggplant, 110 were gabi, 103 were cassava, 86 were okra, and 50 banana. All other species present had at most 5 individuals. Another garden with an area of 68 sq m was found to be almost a monoculture since only eggplant dominated with 110 hills while the other 14 species encountered had only 10 individuals or even less.

Changes in Agriculture Value Chains Encountered by Small-Scale Farmers

The rice value chain in the rice growing barangays of Basey and Marabut is composed of the following segments:

Figure 14. *Income flow in the rice value chain, Basey*



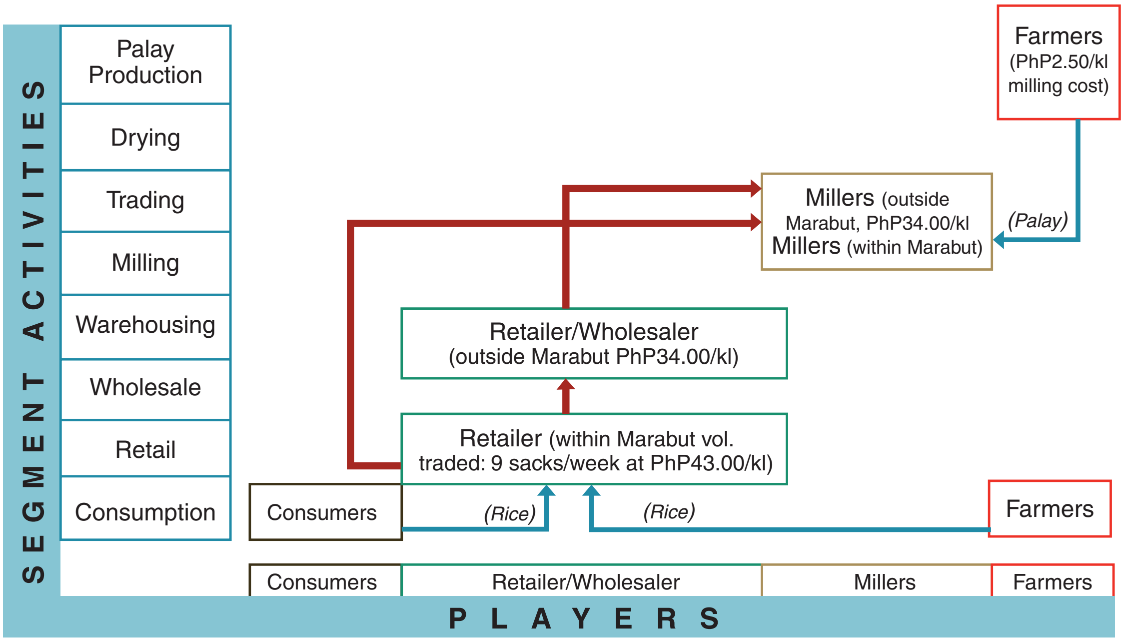
consumption, trading, transformation and production. Each segment of the value chain is composed of actors who perform specific activities and are linked, in order to bring the product to the end customers.

Consumption. Household consumers constitute this segment of the rice value chains in Basey and Marabut. The rice farmers who produce *palay* for their own consumption also constitute this segment. The results of the study showed that the farmers source additional rice from retailers because their own produce is not enough for their own consumption needs. The household consumers and farmers buy rice from retailers. In the main they are particular about the price of rice and source the product from retailers with cheaper prices.

Trading. Rice traders, specifically retailers, were the players that constituted this segment in the value chain. They perform the retailing of polished rice in the end consumer market. All the eight rice retailers (5 from Marabut and 3 from Basey) who were respondents were sole proprietors. They have been in the rice trading business for 5 to 7 years. The rice retailers in the two municipalities have an estimated average capitalization that ranges from PhP10,000.00 to PhP13,000.00. Most of the retailers utilized their own funds as capitalization (2 retailers from Basey and all 4 respondent retailers from Marabut). Two respondent retailers from Basey borrowed funds from creditors for their rice retailing ventures. Rice retailing is one of the varied sources of household income of the respondents. Rice retailers' activities include procurement of rice from rice traders in Tacloban City, storage and retailing of rice to the end consumers. The retailers' residences served as their rice selling stations.

Transformation. This segment is composed of rice millers. All eight rice millers interviewed in Basey and Marabut are only service providers. They do not buy the palay, and hence do not exhibit ownership of the palay produce brought to them. The miller's activity is mainly palay milling. No other post-harvest services such as drying and storage are performed by the miller. The millers were limited to only being paid for milling palay because of the low volume of rice produced in the two municipalities. The results of the study showed that the millers are willing to expand from being service providers

Figure 15. *Income flow in the rice value chain, Marabut*



to being traders of milled rice and providers of other services, given that the volume of production of palay in the municipality will be substantial. The millers interviewed have been in business for 5 to 11 years. Their capital was sourced either from personal funds or loans. During the study the average volume of rice milled per week was low, at eight sacks. When rice production is at its normal level, when the weather is generally favourable for rice production, the millers can mill an average of 60 sacks per week.

Production. Rice farmers constitute the production segment of the rice value chain in Basey and Marabut. The average farm size of rice farmers in Basey is 1 hectare and 0.25 hectares in Marabut. Rice farming is the main occupation of the respondents in both municipalities. The rice produced is intended mainly for their own consumption. During FGD, the farmers articulated that their harvest is insufficient to last until the next harvest. Hence they needed to purchase additional rice from Tacloban City. Other farmers sell palay to millers in Tacloban when there is excess palay and the harvest was more than enough for home consumption. The average palay harvest in Basey is 28 sacks per cropping and it is 19 sacks per cropping in Marabut. The main activities of the rice farmers are production and post-harvest handling of rice, specifically drying.

Value chain analysis starts with the end markets, which define the value of the product they consume. Value may be defined in terms of product characteristics such as price, quality, quantity and accessibility of product. End consumer pays an amount equivalent to the "value" of the product that they buy.

The rice value chain maps for Basey and Marabut and the flow of income in the value chains are shown in Figures 14 and 15. In the rice value chain in both municipalities the income flow or payment flow moves from the consumers to the rice retailers located within the area. For a kilo of polished or milled rice the consumer in Basey pays the retailer an average of PhP42.50 and consumers in Marabut pay the retailer an average of PhP43.00 per kilo of rice. The retailers in Basey and Marabut trade an average of 10 sacks and 9 sacks per week respectively. The price of a kilo of rice bought by the consumers from the retailers consists of the retailer's purchase cost and transportation costs. Most of the consumers in both municipalities are particular about the price of rice. Quality considerations do not affect their decisions about where to purchase rice.

From the retailers in the study areas income flows to other chain actors; the rice retailers and millers outside Basey and Marabut, specifically in Tacloban City. In both study areas, the retailers within the municipality sourced rice from retailers and millers in Tacloban City because local production was very low. Another reason why retailers in Basey sourced rice from Tacloban is because Tacloban City is easily accessible via sea transport. On average the retailers in Basey and Marabut pay the retailers and millers in Tacloban City an amount ranging from PhP1,700 to PhP1,780 per 50-kilogram bag of milled rice.

The mode of payment between the rice retailers and their sources in Tacloban City is cash. However, some retailers from Basey engaged in favourable trading arrangements because of the "suki" system. As a regular buyer from their source in Tacloban City, a retailer can make use of credit and longer payment periods. The basic quality specifications of the retailers in both municipalities are: the rice should be free of odour and not mixed with NFA rice.

The next player in the rice value chain is the miller. However, in both municipalities the millers do not earn income from selling rice to the retailers because they are mainly service providers. Instead the millers earn income from the farmers that use the miller's services. The average milling price paid by farmers to the millers is PhP2.50 per kilo of milled rice. Milling fees are paid in cash.

Since rice production was intended for their own household use, the farmers do not earn income from rice farming. Instead, payment flows from the farmers

Table 16. Rice trading activities and costs (in PhP) in Basey and Marabut (October 2015)

Item	Basey	% Contribution to total cost	Marabut	% Contribution to total cost
Procurement	1, 810.00	91.00	1, 765.00	90.00
Transportation cost	185.00	9.00	190.00	10.00
Total	**1, 995.00**	**100.00**	**1, 955.00**	**100.00**
Cost per kilo	39.90		39.10	
Selling price per kilo	42.50		43.75	
Gross margin per kilo	2.60		4.65	
Ave. volume traded:	10 sacks or 500 kilos per week		9 sacks or 450 kilos per week	

Table 17. Milling costs (in PhP) per week in Basey and Marabut (October 2015)

Item	Basey	% Contribution to total cost	Marabut	% Contribution to total cost
Labor	500.00	71.00	500.00	61.00
Electricity	36.67	5.00	20.00	2.00
Fuel and oil	171.43	24.00	300.00	37.00
Total	**708.10**	**100.00**	**820.00**	**100.00**
Milling cost per kilo of rice	1.47		1.28	
Milling revenue per kilo of rice	2.50		2.50	
Gross margin per kilo	1.03		1.22	
Milling recovery	50%		50%	
Ave. volume milled:	6 sacks or 300 kilos per week		8 sacks or 400 kilos per week	

Farmer Jose Evina working during the harvest time at Samar (©Caritas Czech Republic/Jakub Zak).

to the rice millers who provide milling services. Payment also flows from farmers to the retailers for the purchase of rice when the farmers' own produce was insufficient for their home consumption. As revealed during FGD, farmers tend to sell *palay* to traders or millers outside Basey and Marabut if the harvest is more than enough for home consumption. This happens when the farmer are able to produce rice for two croppings. During the study the rice farmers in the municipality grew rice once a year because most of the farm lands are rainfed.

The income flow, costs and volumes traded in the rice value chains in both municipalities are almost the same, mainly because the retailers from both municipalities sourced the product from Tacloban City. Production potential is higher in Basey given proper irrigation. The results of the study showed that proper irrigation was lacking in Basey and this restricted the production activities of the rice farmers. Meanwhile in Marabut the farmers have smaller farm sizes, hence rice production is low.

Various activities were carried out during the production and processing of palay, and the trading of rice along the value chain. Tables 16 to 17 present the activities and costs incurred in rice trading, palay milling and palay production respectively.

Trading. The main activity of the rice traders in Basey and Marabut is rice procurement. The average volume of rice traded by Basey rice retailers is 10 sacks or 500 kilos per week. In Marabut, the average volume of rice traded per week is 9 sacks or 450 kilos. Procurement costs accounted for 90% of the rice retailers' costs and the other 10% were transportation costs (Table 16). Storage and selling costs are very minimal because the residences of the retailers serve as their selling stations. The retailers in Marabut earn a higher margin per kilo because they have lower costs per kilo and higher selling prices, compared to retailers in Basey.

Milling. Rice millers are mainly service providers. They do not buy palay or sell milled rice. During the study the miller respondents only milled an average of 6 to 8 sacks per week. Milling recovery was 50%. The costs incurred in delivering the millers' service are presented in Table 17. Labour constitutes 70% of the total milling costs for the miller respondents from Basey. The labour cost incurred in providing milling services by the miller respondents in Marabut accounted for 60% of the total milling costs. Electricity costs, mainly from charging the batteries of the milling machines and the lighting of the facility, were relatively low at 5% and 2% of total milling costs for Basey and Marabut millers respectively. Fuel and oil are another cost component for the millers, accounting for 24% (Basey) and 37% (Marabut) of total milling costs per week. On average, millers from both municipalities earn PhP2.50 per kilo of milled rice as revenue. Milling costs per kilo are higher for miller respondents in Basey at PhP1.47 per kilo, compared to PhP1.28 per kilo for the millers in Marabut. Millers in Marabut have a higher volume milled per week because there are few millers in the area. Basey, on the other hand, has numerous millers, mostly in the rice producing barangays.

Production. *Palay* production costs incurred by rice farmers in Basey and Marabut (Table 18) can be grouped into inputs, labour, irrigation and other costs. Labour costs include production activities such as land preparation, cultural management practices and harvesting. For both municipalities, fertilizer accounts for a considerable amount of total costs (Figure 16 and 17). Labour for land preparation is the major production cost item for both municipalities.

Results of the study revealed that the rice farmers produce palay and use the millers' services to have the palay milled. The total cost incurred by the farmers in producing palay and having it milled is summarized in Table 19. Given the estimated average production costs

Table 18. *Palay* production activities and costs (in PhP) in Basey and Marabut (October 2015)

Item	Basey	% Contribution to total cost	Marabut	% Contribution to total cost
Inputs				
Fertilizer	2,375.00	13.00	2,945.36	21.00
Pesticide	1,055.83	6.00	930.89	7.00
Seeds	2,166.67	11.00	1,000.71	7.00
Labor				
Land Preparation	6,665.13	36.00	3,777.86	27.00
Cultural mgt. practices	1, 094.38	6.00	1,544.29	11.00
Harvesting	2,963.94	16.00	1,580.86	11.00
Total Labor Cost	10,723.45		6,903.00	
Irrigation	1,330.00	7.00	984.20	7.00
Other Costs	988.75	5.00	1,235.69	9.00
Total	**13, 388.62**	**100.00**	**13,630.39**	**100.00**
Ave. volume produced:	22 sacks		17 sacks	
Ave. farm size:	1 ha		1/2 ha	

Table 19. *Palay* production and milling costs (in PhP) in Basey and Marabut (October 2015)

Item	Basey	% Contribution to total cost	Marabut	% Contribution to total cost
Cost of *palay* production (per kilo)	44.46	95.00	42.02	98.00
Cost of milling (per kilo)	2.50	5.00	2.50	2.00
Total	**46.96**	**100.00**	**44.52**	**100.00**
Market Price	42.50		43.00	
Price difference	4.46		1.52	

Figure 16. *Palay farmer's production costs and contribution to total costs in Basey (October 2015)*

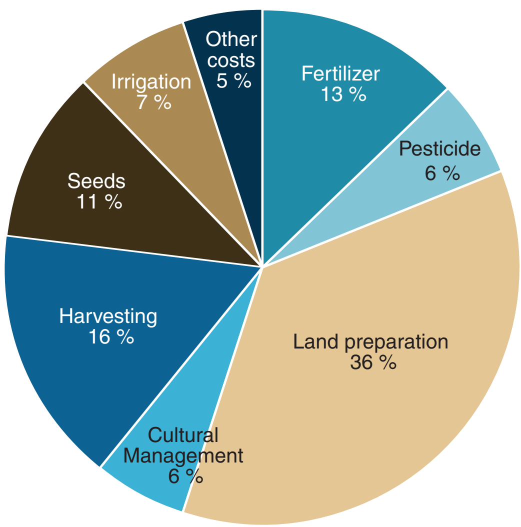
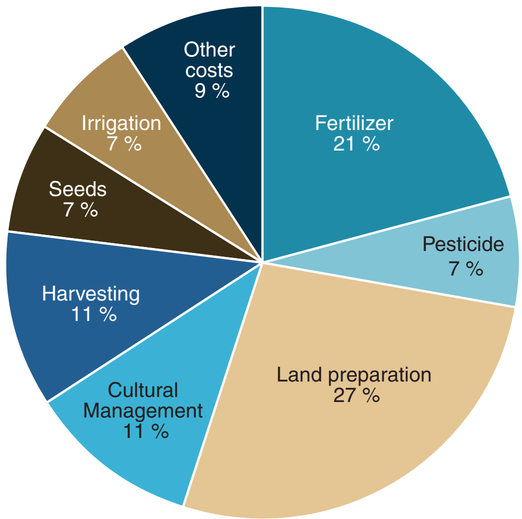


Figure 17. *Palay farmer's production costs and contribution to total costs in Marabut (October 2015)*



at current production volume and the milling costs incurred by the farmers, the results showed that the farmers will be better off buying rice from retailers in the market instead of producing palay and having it milled for their own consumption. The estimated cost of production for the rice farmers in both municipalities was high because of the low volume. Hence, economies of scale cannot be attained.

Changes in Vegetable Value Chains

The vegetable value chain in the "pinakbet" vegetable growing barangays of Basey and Marabut is composed of consumption, trading, and production segments. Each segment of the value chain is composed of actors who perform specific activities and are vertically linked in order to bring the product to the end consumers.

Consumption. End consumers, mainly household consumers, constitute this segment of the vegetable value chain in Basey and Marabut. In the study areas the vegetable farmers are the main producers of these commodities, and they are also some of the actors that comprise this segment.

Trading. Trading is comprised of vegetable retailers or traders. The results of the study show that the vegetable retailers source vegetables from the farmers in their own barangay or municipality. All the vegetable retailers interviewed were sole proprietors. They have been involved in vegetable trading for about 3 to 6 years and mostly trade "pinakbet" vegetables, which includes bitter gourd, squash, string beans, eggplant and okra. The average volume of vegetables traded every week ranged from 11 to 17 kilos of *"pinakbet"* vegetables.

Production. Vegetable farmers are the main players in this segment of the vegetable value chain. In both municipalities, the average area planted with vegetables is 1/8 hectares, and that is backyard level production only. The average volume of *"pinakbet"* vegetables produced in one cropping by the farmers in Basey and Marabut is 20 kilograms and 31 kilograms respectively. In general, most of the farmers grow vegetables for their own consumption. There are also farmer-respondents who grow vegetables as a source of family income. When the farmers' vegetable produce has more than met their consumption needs and there is a surplus, the farmers sell the vegetables to earn some cash. Part of the income

Figure 18. *Income flow in the vegetable value chain in Basey*

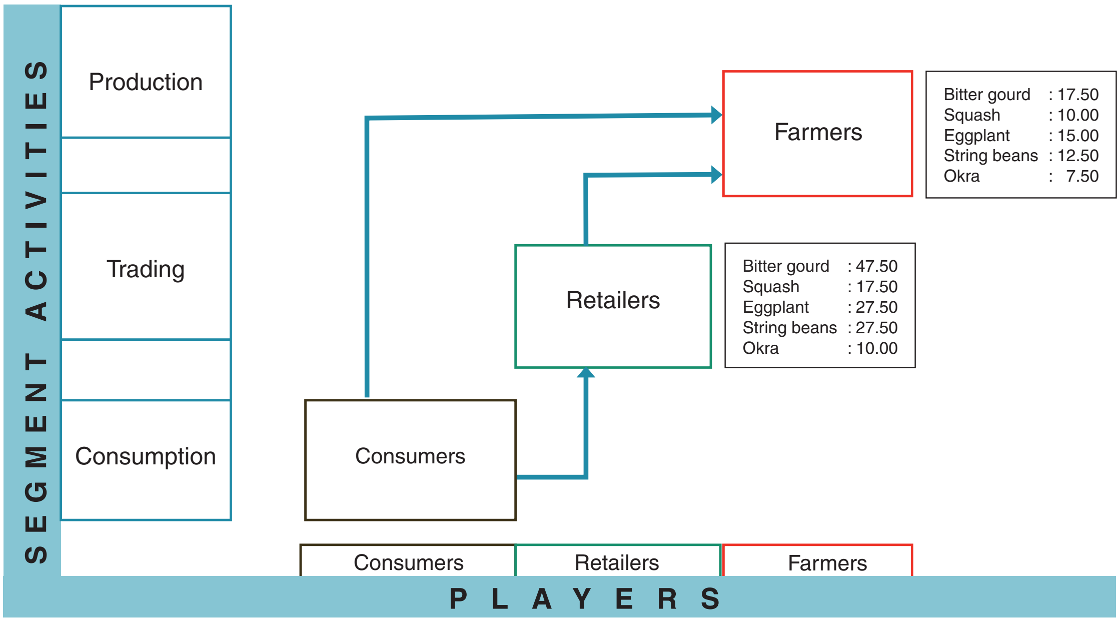
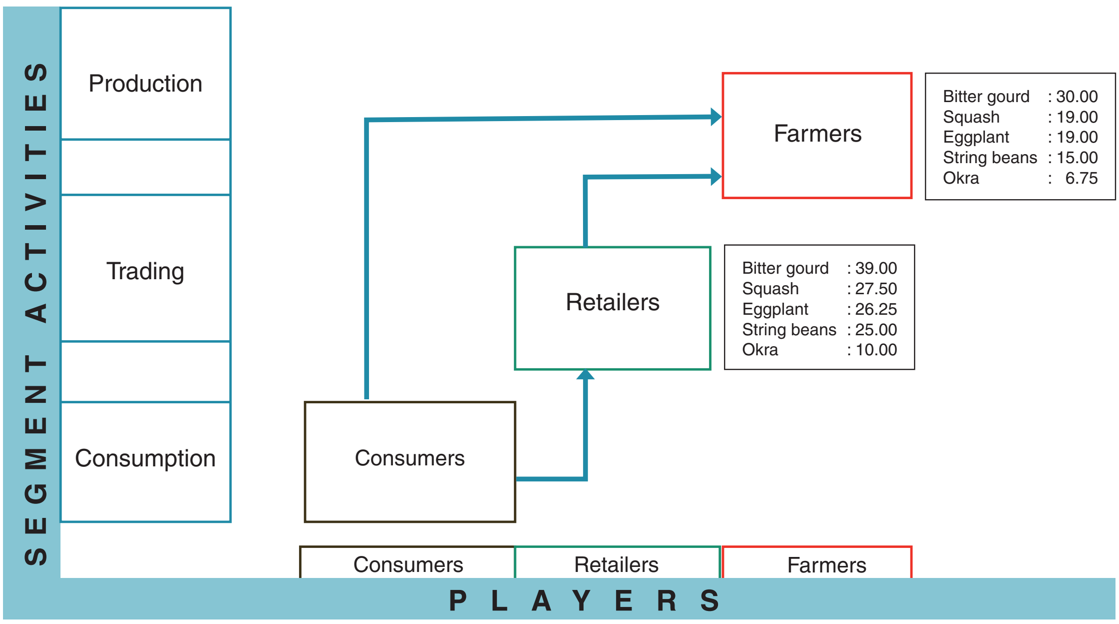


Figure 19. *Income flow in the vegetable value chain in Marabut*



Farmer beneficiaries in barangay Cogun are preparing materials for organic liquid fertilizer (©Caritas Czech Republic/Jakub Zak).

from selling vegetables can be used to purchase inputs. The excess produce is usually sold by roving around the barangay. In most cases the consumers and vegetable retailers buy vegetables from farms or from the residences of the farmers. The results also showed that the farmers' excess harvests are given to their relatives or neighbours instead of being sold.

One farmer respondent in Marabut was engaged in a vegetable growing enterprise for the purpose of earning a profit. This respondent aimed to sell produce to institutional buyers. The sole institutional buyer was the mayor of Marabut. One constraint identified by the respondent was the lack of a market larger than household consumption for the vegetables.

In the vegetable value chains in both municipalities (Figure 18 and 19) the income flow or payment flow moves from the consumers directly to the farmers in the area. Income also flows from the consumers to the retailers and then from the retailers to the farmers.

When the consumers directly purchase vegetables from the farmers, the income flows directly to the farmers. The consumers in Basey pay for vegetables at farm gate prices, as follows: bitter gourd at PhP17.50 per kilo, squash at PhP10 per kilo, eggplant at PhP15 per kilo, string beans at PhP12.50 per kilo, and okra at PhP7.50 per kilo. The farmers earn the same amount of income per kilo for each type of vegetable when retailers source vegetables from them.

When consumers buy vegetables from retailers, income flows from the consumers to the vegetable retailers. The consumers spend a higher amount of money when they purchase vegetables from retailers, as follows: PhP47.50 per kilo of bitter gourd, PhP17.50 per kilo of squash, PhP27.50 per kilo of eggplant, PhP27.50 per kilo of string beans and PhP10 per kilo of okra.

In Marabut farmers earn a higher income per kilo for bitter gourd, squash, eggplant, and string beans compared to the farmers in Basey. Vegetable retailers in Basey earn

Table 20. Vegetable trading activities and costs (in PhP) in Basey and Marabut (October 2015)

Item	Basey			Marabut		
Procurement	Bitter gourd	:	17.50	Bitter gourd	:	30
	Squash	:	10	Squash	:	19
	Eggplant	:	15	Eggplan	:	19
	String beans	:	12.50	String beans	:	15
	Okra	:	7.50	Okra	:	6.75
Selling price per kilo	Bitter gourd	:	47.50	Bitter gourd	:	39
	Squash	:	17.50	Squash	:	27.50
	Eggplant	:	27.50	Eggplant	:	26.25
	String beans	:	27.50	String beans	:	25
	Okra	:	10	Okra	:	10
Gross margin per kilo	Bitter gourd	:	30	Bitter gourd	:	9
	Squash	:	7.50	Squash	:	8.50
	Eggplant	:	12.50	Eggplant	:	7.25
	String beans	:	15	String beans	:	10
	Okra	:	2.50	Okra	:	3.25
Ave. volume traded:	Bitter gourd	:	25 kls	Bitter gourd	:	13 kls
	Squash	:	35 kls	Squash	:	36 kls
	Eggplant	:	15 kls	Eggplant	:	22 kls
	String beans	:	19 kls	String beans	:	14 kls
	Okra	:	22.5 kls	Okra	:	8.6 kls

a higher margin per kilo for bitter gourd (PhP30 per kilo) than retailers in Marabut (PhP9 per kilo). On the other hand, vegetable retailers in Marabut have a higher profit margin from selling vegetables. Squash is bought from farmers at PhP19 per kilo and sold to consumers at PhP27.50 per kilo. The incomes of the retailers from eggplant, string beans and okra are almost the same in both municipalities.

The *"pinakbet"* vegetables in Basey and Marabut are produced by the farmers in the vegetable growing barangays and sold to the end consumer by the vegetable retailers within the municipality. The consumers also buy vegetables directly from the farmers. To be able to produce vegetables and bring them to the consumers, activities were performed by the vegetable retailers and farmers. These activities and the costs incurred in performing them are shown in Tables 20 and 21.

Trading. The main activity performed by vegetable retailers in both municipalities is the procurement of vegetables from farmers. They incur no transportation costs mainly because the retailers assemble only a small amount of vegetables and personally travel around the vegetable producing barangays in the municipalities. The retailers in the study areas do not account for other costs such as losses or shrinkage either. Table 20 presents the procurement cost, selling price and gross margin for each type of "pinakbet" vegetable traded by the retailers. Retailers in Basey earn the highest margin from selling bitter gourd, while retailers in Marabut earn the highest gross margin from string beans. Retailers in Basey earn higher margins from all four vegetables except for squash, compared to the gross margins earned by the retailers in Marabut.

Production. Vegetable production costs incurred by the farmers of Basey and Marabut consist of input costs and labour costs. Seeds are the main cost component in the vegetable production of the farmer respondents in the two municipalities. During the study seed input was provided free of charge by organizations that provide help for farmers. The cost of seeds was estimated.

The farmers did not incur costs for pesticides or fertilizers because they practice traditional pest control

Table 21. Vegetable production activities and costs (in PhP) in Basey and Marabut (October 2015)				
Item	**Basey**	**% Contribution to total cost**	**Marabut**	**% Contribution to total cost**
Inputs				
Fertilizer	0.00	0.00	0.00	0.00
Pesticide	0.00	0.00	0.00	0.00
Seeds	2, 550.00	68.00	3, 000.00	79.00
Labor				
Land Preparation	472.22	13.00	303.00	8.00
Cultural mgt. practices	444.44	12.00	250.00	6.00
Harvesting	250.00	7.00	250.00	7.00
Total Labor Cost	1, 166.66		803.00	
Total	**3, 716.66**	**100.00**		**100.00**
Ave. volume produced per cropping:		20.25 kls		31.14 kls
Ave. farm size:		1/8 ha		1/8 ha

mechanisms and apply backyard-produced organic fertilizers. For the vegetable farmers in Basey, land preparation and other cultural management practices account for 13% of their total costs. Labour costs at harvesting were 7% of total costs. In Marabut, labour costs for land preparation, cultural management practices and harvesting were almost the same, at 7% of total cost.

Implications of Changes in the Value Chains on Small-Scale Farmers

The major crop of Marabut was coconut. Coconut production and fishing are the main agricultural activities. The major crop of Basey used to be coconut. The other major crop was rice. Basey was also known for "tikog". The stalks of this plant were used as raw material for weaving mats and other handcraft products.

After ST Haiyan inputs for rice and vegetable production were provided by various organizations that provide recovery support after the provision of emergency relief. As a recovery program, vegetable production was generally at backyard level and production volume was intended for home consumption. During this study vegetable production remained at the same level (except for a key farmer respondent in Marabut who produced a larger volume of vegetables). On the other hand, rice production was also small, with an average farm size of 0.5 hectares in Marabut. In Basey, the size of the average rice farm was 1 hectare.

The post-Haiyan rice and vegetable industries in Basey and Marabut are characterized by small players and consequently by small production volumes. Rice and vegetable production of the farmers are generally intended for home consumption. The rice retailers in both municipalities import rice from Tacloban City in Leyte to supply the local market.

Study results indicate that rice and vegetable producers in both municipalities are restricted by farms size, relevant

Editha Bayarong working in communal garden
(©Caritas Czech Republic/Jakub Zak)..

rice and vegetable production knowhow, lack of capital and inputs (for the next cropping) and incidences of pests and diseases. The municipality of Basey has a higher rice production potential. The rice farmers identified the problem of unmanaged irrigation facilities contributing to low production.

Table 22 shows the various constraints identified in both rice and vegetable value chains in Basey and Marabut, Samar. Interventions could be done along these various segments or activities.

The rice and vegetable value chains in Basey and Marabut are both characterized by a market-based chain governance, with only "arm's length" transactions between the segment players. There is no formal cooperation among participants in the value chain.

Problems and Issues Encountered by the Farmers

One of the major issues affecting the small-scale farmers of Basey and Marabut involved the inadequate government support to farming households and communities in order for them to be use technologies to improve production and food security. For example, there was a noted absence of official participation in the management of about 500 ha of swamps in Basey. To a certain extent, the cultivation of these swamplands could increase the production capacity of Basey, and contribute to the food security of its inhabitants. Various modes of utilization of swamplands, however, could have implications on the emission of greenhouse gases (GHGs), which in turn could contribute to changes in the production environment (Dargantes et al., 2014.).

For Marabut, there was also a noted absence of an official articulation of proactive engagement in rice production on 115.57 ha representing 2.01% of municipal agricultural lands. Although this area could be seen as quite small and insignificant, government intervention could improve production levels and eventually contribute to food security. Considering that this area could also be part of the southern Samar swamplands, interventions on the production environment itself would need to be reckoned with the on-going climate change adaptation and mitigation initiatives in agriculture (for example Cruz, 2015).

A positive aspect in the provision of government support in Basey involved the inclusion of an irrigation development plan in the Municipal Comprehensive

Table 22. Problems and constraints identified in the rice and vegetable value chain in Basey and Marabut (October 2015)

Segment /Activity	Rice	Vegetables
	Problem/Constraints	Problem/Constraints
Production	1. Limited knowledge on rice production	1. Limited knowledge on vegetable production
	2. Lack of inputs	2. Lack of inputs
	3. Low production volume because of small farm size	3. Low production volume because of small farm size
	4. Incidence of pests	4. Incidence of pests
	5. Lack of capital	5. Lack of capital
	6. Irrigation (Basey only)	
	7. Soil fertility/ acidic soil (Basey only)	
Trading	1. Lack of capital	1. Lack of market information - Where to sell?
	2. Farm-to-market road (Basey)	2. Lack of knowledge on post-harvest practices
Milling	1. Low volume of palay to be milled	
	- Idle capacity	
	- Cannot provide additional services such as drying and storage	

Area cleaning and land preparation intended for a rice field (©Caritas Czech Republic/Jakub Zak).

Development Program (CDP), otherwise known as the CLEAN Basey Rural Development Strategy. This irrigation development program targeted more than 5,380 ha of potential lowland rice production areas. The problem involved the inadequacy of financial investments for the completion of the program. This meant that large portions of the identified potentially-irrigable areas became rainfed riceland or fallow, idle land because of the effects of the 2015 El Niño Southern Oscillation (ENSO). The situation, characterized by an environmentally and economically unsustainable food production system, contributed to an unsustainable supply of adequate food, not only to the farmers, but also to the other residents of the municipality.

The lack of irrigation has been exacerbated by the intrusion of sea water into 195 ha of low lying areas. These ricefields in the Barangays Canmanila, Iba and Sawa were deemed productive mainly during the karayapan cropping season between December and April because the rain would flood the fields and thereby prevent sea water from intruding into the production areas. However, during the baksalan cropping season from June to October the high tide coupled with lower rainfall intensity would lead to increased saltwalter intrusion into these areas. Local government agricultural extension workers introduced saltwater-tolerant rice varieties for planting in these areas, but farmers reported that the trials were unsuccessful, most likely because of the extremely high salt accumulation in the soil. Apparently, minimizing the intrusion of seawater would require the operationalization of a functional irrigation system during the baksalan cropping season, and the rehabilitation of the mangrove forests. Their decimation was cited by the farmers as having contributed to the incursion of sea water into their paddy fields.

In Marabut, there was a noted positive contribution to family consumption and diet by the Household-Based Vegetable Production Program. Reportedly, the local residents were able to have direct access to, and consume, vegetables produced in the home gardens. They claimed that home garden-based production in conjunction with food relief assistance allowed them to overcome extreme food insecurity in the aftermath of ST Yolanda. Although the Marabut LGU had been keen on implementing a commercial vegetable production program, there was no significant mention of the extent of the contribution to the program by the agri-enterprise development thrust of the municipality. The visible result of the plan was the establishment of a two-hectare farm which cost PhP 585,000. A value chain analysis for the operationalization of a local vegetable-based agri-enterprise development program was also not included in the existing plan.

Another issue affecting the small-scale farmers of Basey and Marabut revolved around government support for the development of integrated agricultural extension services and facilities, and rural organizations. Local government reports, farmer interviews and FGDs indicated that agricultural extension services in Basey mainly came in the form of farm inputs which were distributed by the LGU and the national DA (for example fertilizers, rice and vegetable seeds, and coconut seedlings). In Marabut, farmers reported having received corn seeds (which had varying germination rates), and women's groups revealed that they had received swine stocks for fattening. NGOs were reported to have provided various items of farm equipment, seeds and cash to selected individuals, as well as training on such topics as organic farming and natural farming systems.

Vegetable seedling (©Caritas Czech Republic/Jakub Zak).

However, most of the problems emanated from the identification of conduits for these agricultural facilities and services. Whereas farmers in both municipalities preferred the support to be channeled to their respective associations in order to reach more beneficiaries, barangay LGU officials reported that the lack of coordination between the service providers and the local officials resulted in a non-inclusive provision of services and facilities, and an unequal sharing of benefits. These differences in perspective contributed to the formation of separate farmers' organizations. Some were organized by LGU extension workers to serve as conduits for the distribution of farm inputs and the provision of services from government agencies. Others were formed by civil society organizations to serve as channels for various production inputs, services and facilities. Such diversification of conduits would expand the reach of the assistance provided to farmers. Key infomants disclosed the multiple modes of distribution led to a few farmers deriving benefits from multiple sources, and to an undetermined number of farmers being not included in the beneficiary list of the various service providers.

One other issue that could affect the small-scale farmers, and more importantly the mat-weavers and embroiderers of Basey, involved government support for natural resource management and food security activities which took into account the differences between subsistence and market-oriented agriculture. According to the municipal profile of Basey, mat weaving and embroidery had been long famous because of the beautiful designs of the products, and because their manual skills had allowed 60 percent of the residents to earn income from this industry. Reportedly, many home-based enterprises which produced tikog mats were awaiting the influx of capital, technology and modern management. Local tikog products include embroidered mats, attractive wall decorations, elegant dividers and fine bags.

However, according to observations, the problem was that most of the tikog used in the production of the aforementioned handicrafts was already being imported

Land preparation in Buena Vista with a mud boat donated to the farmer association by Caritas Czech Republic (©Caritas Czech Republic/Jakub Zak).

from various towns of Leyte, because local production was deemed very inadequate to meet the needs of the mat-weavers and embroiderers. The inadequacy of the local supply of raw material was, reportedly, brought about by the shift in rice production practices among small-scale farmers. They had changed from the traditional carabao-powered payatak system to the hand-tractor-dominated, land preparation practice. The intensive use of hand tractors (locally known as turtles or mudboats) coupled with the introduction of straight-row planting smothered the tikog plants that used to co-exist with the rice, and prevented their regrowth after rice planting. As a consequence, farmers were no longer able to harvest tikog after the main rice crop had been harvested. Despite the knowledge about the decimation of local tikog production, and the reliance of a sizeable portion of the population on tikog for their livelihood, no program was in place to address this natural resource management and food security area of interest.

The small-scale farmers of Marabut further faced the issue of government support for the economic integration of agricultural and forestry activities in order to take effective measures in encouraging forest management and the growing of trees by farmers as an option for resource development. Although the Highway Fruit Tree Program and Reforestation being planned by the Marabut LGU could make a positive contribution to local resource development options, the absence of articulation of an integrative initiative of a similar nature for the 5,232 ha of devastated coconut lands, and 85 ha of open lands could limit local options for agri-enterprise development. Similarly, the absence of a proactive articulation of possible interventions in 8,442 ha of timberlands within Marabut could minimize opportunities for the interphase of forest ecosystems and agroecosystems within the context of ensuring local food security.

4 Conclusions and Recommendations

For the rice farmers of Basey and Marabut, it would be a major challenge to enter local markets as this would involve being able to produce a surplus which could extend beyond an "arms-length" transaction in the value chain. Prior to and even after ST Haiyan, the rice produced by the Basey and Marabut small-scale farmers was barely sufficient for their subsistence needs. Any meagre surplus was sold, and mainly consumed locally.

Most of the rice that went beyond the realm of household-level consumption could mainly be attributed to credit arrangements (locally known as *pahulod* or *palangoy*) entered into by the small-scale farmers. Under these credit arrangements, small-scale farmers could avail themselves of loans up to PhP10,000 for every hectare of riceland (usually determined on the basis of the quantity of seeds) payable upon harvest. With a repayment scheme which involved paying back the loan amount plus the interest of one sack (approximately 50kg) of palay for every PhP1,000 borrowed, farmers could end up paying back 15 sacks of newly-harvested rice for every PhP10,000 borrowed. Although from a market entry perspective, this would represent a volume of 15 sacks (approximately 750 kg) of palay for every hectare covered by such a credit arrangement, this volume would also represent the quantity of rice being removed from the inadequate food supply of small-scale rice farmers.

Farmer from Cogun is observing preparation of organic fertilizer
(©Caritas Czech Republic/Jakub Zak)..

This situation would indicate two obstacles: Firstly, small-scale farmers would need credit arrangements that would be less usurious than the *pahulod* or *palangoy* systems; and secondly, they should be provided with irrigation support to enable them to regularly have two croppings per year. Overcoming the first obstacle would allow farmers to retain a significant portion of their harvest for their food requirements; while surmounting the second would allow the farmers to produce more than their subsistence requirements

If the small-scale farmers could generate surplus production, the entry of their product into the market would have to contend with the higher cost of producing milled rice from local produce as compared to the lower market price of rice coming from other places. Considering that 95 to 98 percent of the cost of rice could be attributed to the cost of production, any intervention to lower the price of milled rice would require the implementation of more efficient production practices. This, in turn, would require that farmers have the knowledge and skills to implement such practices, as well as the farm inputs necessary for the successful implementation of such practices.

Considering that rice production in both municipalities had been traditionally undertaken in swamplands (environments that had been rarely studied especially in terms of climate change impacts) the introduction of technology to lower production costs should already be reckoned with climate change mitigation and adaption measures for wetlands. Apparently, the transfer of such knowledge and the dissemination of information would

Farmers transplanting eight-day-old organic rice seedlings in Buena Vista (©Caritas Czech Republic/Jakub Zak).

require retooling of the agricultural extension workers and capacity strengthening of the farmers to implement climate-resilient and economically-viable production practices.

If the cost reduction option could not be pursued, product entry into the market could be achieved through the more aggressive introduction of high-value specialty rice. Considering that NGOs and some farmers organizations had already tried the production of these specialty rice varieties, their marketing for special uses could circumvent the higher price constraint faced by locally-produced rice. However, market participation would require not only community-based social preparation for the shift from mainstream rice varieties to specialty varieties, but also the economic organization to develop cooperation among value chain actors and to strengthen weak segments of the value chain itself.

Among vegetable growers, the production of surplus was achieved locally, but the absence of mechanisms to develop cooperation among value chain actors and to strengthen forward linkages in the value chain were major challenges in the market entry of local products. Post ST Haiyan experience showed that the distribution of vegetable seeds for planting in home gardens not only led to the availability of food for the household, but also to tangible production losses. Such experience of loss left a negative imprint on the local residents, who revealed that a market-oriented vegetable production program should already take into consideration forward linkages in the value chain. Such forward linkages could be in the form of on-site or of community-based processing.

Strategies to Strengthen the Right-to-Food of Small-Scale Farmers

In order to strengthen the right-to-food of small-scale farmers, the first issue to address is the concern to achieve an adequate supply of food produced from environmentally and economically sustainable food production systems. This would entail the adoption of strategies that should include components for the provision of support which would enable farmers to apply technologies to improve

Old shoes used as a rice field marker (©Caritas Czech Republic/Jakub Zak).

food production outputs. It would require official proactive participation in the management of swamplands and underutilized agricultural lands. The DA-RFO8-LGU (The Department of Agriculture Regional Field Office 8 – Local Government Unit) collaboration in the implementation of this strategy could hasten the design and implementation of land management systems including the development of irrigation and the prevention of saltwater intrusion into low-lying ricefields. Such articulation could emanate from a two-tiered policy. At the sub-national level, the DA-RFO8 could come up with a climate change compliant intervention scheme for the swamplands and idle agricultural lands in the two municipalities that could be reflected in the *Palay* Development Roadmap or in the Eastern Visayas Agricultural Modernization Plan. At the local level, the municipal LGUs could update their respective agricultural modernization plans, which could then be incorporated into the Municipal Development Plans (MDPs). In this regard, the DA-RFO8 and the LGUs would need to coordinate their respective efforts in order to set up coherent and climate change resilient agricultural development plans at both levels, coherent and climate change resilient.

This could entail a landscape approach to planning the availability dimension of the right to food. It would not only allow for environmental sustainability of production systems but also improve resource allocation decisions including those related to the equitability of access to food supplies (for example Cruz, 2015). The DA-RFO8 and the municipal LGUs should already initiate proactive engagement to address natural resource management and food security issues, and to provide support to economic integration of agricultural and forestry activities as options for resource development. Another aspect to facilitate economically sustainable food systems would be the provision of services and activities to strengthen backward linkages. This would support access to and utilization of resources necessary to ensure sustainable livelihoods (e.g. protection to access and tenure to livelihood assets) and forward linkages for participating in value added activities.

For the delivery of integrated agricultural extension services, there would be a need to strengthen rural organizations, particularly people's organizations, farmers' associations, women's groups and rural cooperatives. This must be achieved through establishing mechanisms and processes that would ensure their participation in the planning, implementation, monitoring and evaluation of agricultural development programs, and of value chain development initiatives. Stronger rural organizations could facilitate the sustainable production of food supplies and ensure the availability of such food stocks to the non-farming people. Moreover, forward linkage in the value chain could mean the localized processing of agricultural products which could eventually promote rural industrialization. Moreover, forward linkage in the value chain could mean localized processing of agricultural products, and thereby promote rural industrialization. Improvements in productivity and an increase in market participation could eventually induce social and economic adjustments, especially with regards to the reduction of poverty in Samar, and more particularly in the municipalities of Basey and Marabut.

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