Weather index insurance under CCAP

A feasibility study

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Abbreviations

ANTRECCO	Agusan del Norte Teachers Retirees Communities Cooperative
CARD	Centre for Agriculture and Rural Development
CCAP	Climate Change Adaptation Project
CLIMBS	Coop Life Insurance and Mutual Benefit Services
DA	Department of Agriculture
DOLE	Department of Labour and Employment
DTI	Department of Trade and Industries
ET	Evapotranspiration
FAO	Food and Agriculture Organization
GSIS	Government Service Insurance Scheme
GTZ	German Technical Corporation
IC	Insurance Commission
IGIDR	Indira Gandhi Institute for Development Research
ILO	International Labour Organization
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
LGU	Local Government Unit
MDG-F	Millennium Development Goal-Fund
NASA	National Aeronautics and Space Administration
NSO	National Statistics Office
OCD	Office of Civil Defence
OPV	Open Pollination Variety
OTOP	One Town One Product
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PagIBIG	Pagtutulungan sa Kinabukasan: Ikaw, Bangko, Industria at Gobyerno
PCIC	Philippines Crop Insurance Corporation
RTR	Remedios T. Romualdez
SSS	Social Security Scheme
UN	United Nations
VBARD	Vietnam Bank for Agriculture and Rural Development
WFP	World Food Programme
WIBI	Weather index based insurance

Contents

1 Introduction

This document discusses feasibility of implementing Weather Index Based Insurance (WIBI) pilot under Climate Change Adaptation Project (CCAP) in a select few sites in Agusan del Norte, a province of Caraga region on Mindanao islands of Philippines. CCAP is a part of a larger initiative named “Joint Programme on Strengthening the Philippines’ Institutional Capacity to Adapt to Climate Change” implemented jointly by United Nations with the Government of Philippines with support from Spanish government through the United Nation’s MDG-Achievement Fund. CCAP is implemented by the International Labour Organization (ILO), a specialized agency of the United Nations together with the Department of Labor and Employment (DOLE), Department of Trade and Industry (DTI) and the Province of Agusan del Norte. Under this, Philippines Crop Insurance Company (PCIC) would underwrite innovative insurance products, based on weather index.

1.1 Objective

The objectives set forth before writing this report were as follows:

1. Understand weather risks at various levels in the priority area of CCAP
2. Understand the availability of the data essential to create WIBI contracts at various levels
3. Propose best possible products in the current context and current season for areas of CCAP
4. Comment on the way forward for the next seasons

1.2 Methodology

Most of this report extensively relies on the work already done by the CCAP partners on the field. Apart from the references to the Vulnerability and Adaptation Assessment Report, Baseline Study Report and Value Chain Analysis Report, we have also used the following approaches to build the study:

1. Interviews with Municipal Focal Teams of LGUs, and particularly Agriculture Officers of RTR and Buenavista
2. Interaction with Jeff Lawrence (Country Director of ILO) and Lurraine Villacorta (Project Manager of CCAP)
3. Interactions with the management of Philippines Crop Insurance Corporation (PCIC), particularly Norman Cajucom (Senior Vice President), Carmen Hutaba (Vice President), Atty. Rosa Gatinao (Regional Manager for Region X), Roy Alamban (Acting Marketing Chief for Region X) and Romeo Salting (Regional Manager for Region IX)
4. Interactions with the key partners of ILO under CCAP, namely Department of Trade and Industries, Department of Labour and Employment, Agusan del Norte Provincial Government
5. Interactions with Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) officers (Manila and Bancasi Airport Offices) and weather data collected from PAGASA and NASA (provided by the regional office of the Department of Agriculture)
6. Interactions with FAO, Manila Office
7. Interviews of corn and rice specialists from the Department of Agriculture, Caraga Region Office
8. Interactions with officers of Office of Civil Defence (OCD), Caraga Region

9. Interviews of officers of several cooperatives, banks and associations involved in agriculture lending in Caraga region like People's Bank of Caraga, ANTRECCO, CARD Inc, Enterprise Bank, FICCO, Surigaonon Rural Banking Corporation and Land Bank
10. Interactions with Prof. Daniel Osgood[1] (Columbia University), Prof Travis Lybbert (University of California, Davis Campus), Ruth Hill (IFPRI), Gabriele Ramm (GTZ), Francesco Rispoli (IFAD), Niels Balzer (WFP), Alok Shukla (TATA AIG General Insurance Company) and Sarthak Gaurav (IGIDR)
11. Interactions with individual farmers from the four priority municipalities

1.3 Structure of the report

Chapter 2 discusses about the planned interventions under CCAP and particularly about WIBI. Chapter 3 describes risk profile of the residents in the priority area of CCAP and in a way summarizes the WIBI development related findings of *Vulnerability and Adaptation Assessment Study* carried out under CCAP. Chapter 4 lists various risk management techniques adapted by the people of the concerned area whereas Chapter 5 discusses technical aspects of designing possible WIBI products. An assessment of capacity of the insurance supply chain players and regulations is carried out in Chapter 6 whereas Chapter 7 concludes the document with the specific recommendations.

2 Planned interventions under CCAP

In the context of increasing world-wide discussions on the hazards of climate change - particularly affecting the agrarian population of poorer nations, it becomes essential to look into the possible ways of integrating risk management mechanisms into the current financial systems. UNFCCC (2007) specifically emphasizes the need of having a sound adaptation strategy and involving risk sharing and risk transfer mechanisms like insurance. Weather index based insurance (WIBI) or climate insurance could be one of such efforts in this direction. WIBI is a recent innovation in the agricultural risk management sector and is believed to address many of the issues faced by the existing indemnity based insurance schemes and area yield index insurance schemes[2]. The most distinct feature of weather index insurance is the simplicity of the process of claim estimation as the insurance payouts do not depend on the manual field loss assessments but rather on the pre-agreed index triggers. Designing of such insurance incorporates analysis of the historical weather information unlike the design of traditional crop insurance where focus is on historical losses.

Within the duration of three years (2009 to 2011), CCAP will develop and test several financial safety nets in the selected priority areas of province of Agusan del Norte. The products include credit for certain micro-enterprises and WIBI. A flow diagram of planned interventions under CCAP could be found in Figure 1. We hope that the document could serve as a guide for the product designers and implementers involved in this initiative to develop and scale up WIBI schemes in Agusan del Norte province of Philippines.

[1] Prof. Osgood is the official mentor appointed by ILO's Microinsurance Innovation Facility for the Microinsurance Fellow for this project.

[2] Hellmuth, M. E., et al., 2009, 'Index Insurance and Climate Risk: Prospects for Development and Disaster Management', International Research Institute for Climate and Society, Columbia University

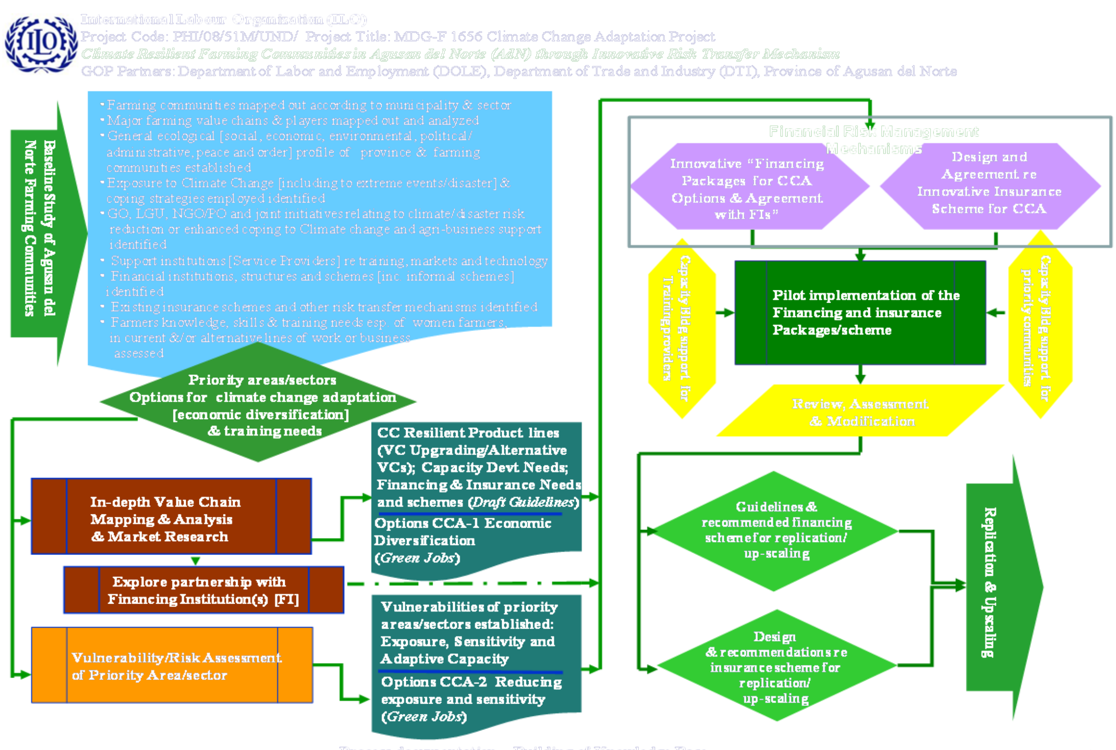
2.1 Priority areas identified under CCAP

After conducting a baseline study in all of the municipalities of Agusan del Norte, ILO along with its partners selected four municipalities as the priority areas for intervention. These are namely Buenavista, Jabonga, Las Nieves and Remedios T. Romualdez (RTR). The financial schemes are envisaged to be launched in these municipal areas. The feasibility study is hence applicable only to these four municipalities. A brief geographical profile of these municipalities is given in Annexure 2.

2.2 Concept of weather index insurance

Weather index insurance, in true sense, is a 'bet' on the index formed from weather parameters, modified to help the insured customers. In fact some contend that it is actually a derivative, with weather index as the underlying entity. To work as insurance, the index of this derivative should reflect actual losses of the insured. It is observed that bad weather usually causes decrease in the production which results in loss of income for the farmers. A weather index designed in such a way that it highly correlates with the production losses could be used as an underlying for the derivatives. One of the market players for such derivatives could be farmers whereas the other party could be insurer. The farmers could receive payouts from the insurer when the index indicates bad weather for crops from such derivatives. It should be noted that in such case, the payout of the derivative would solely depend on the weather index and not on the actual assessment of the farmer's losses on the field.

Figure 1: Planned interventions under CCAP



Source: ILO CCAP planning documents

2.2.1 Benefits

There could be many benefits of such insurance scheme over the traditional insurance. In the traditional crop insurance, crop losses are measured by manual assessment procedures. This needs the insurance professionals to physically visit the insured farm. Moreover it also indicates high dependence on manual judgment of losses unless a robust crop loss measurement procedure is in practice. The insured farmer might also decide not to look after the crops, which creates the problem of moral hazard. Further, if the insurer does not exclude the high risk areas, farmers from such areas would tend to buy the insurance regularly and would receive payouts in almost all the seasons[3]. The index insurance approach addresses many of these challenges. As the payout is dependent on the weather parameters measured by a third party, there is little scope of the judgmental errors from the insurer. This also makes WIBI more attractive than the traditional schemes for reinsurers, which decreases the burden on the insurer to diversify the risk internally. Due to reduced burden on the human resources and due to higher reinsurance availability, the insurer can quickly increase their portfolio to cover more and more farms. Further, the simplicity of measuring losses directly reflects into reduced claim settlement time. Moreover, if the parameters are made publicly available, the farmers themselves could calculate the expected claims at the end of the insurance period and thus could reduce potential disputes on the size of the claim between the farmers and the insurer. As claims are systemic in nature, all the farmers in a particular area availing a certain policy would receive same payouts. This clearly decreases the possibility of adverse selection mentioned earlier.

2.2.2 Ideal Index

As a thumb rule, an ideal index for WIBI should possess the following properties:

- It should be a good proxy for losses
- Data for building the index should be easy to obtain
- Data for index should be from reliable sources
- Data for index should have historical presence

2.2.3 Challenges

The benefits mentioned above do not indicate that WIBI is a panacea of all the problems faced by crop insurers. Basis risk is a key challenge faced by insurers while implementing WIBI, particularly in the developing countries. The word basis risk is related to the risk of paying out inaccurate claims. As mentioned earlier, WIBI claims are solely dependent on weather parameters measured by a third party. If the weather index of WIBI is poorly built, it might not correlate well with the crop losses. Further, if the weather experienced by the farm is different than the weather experienced at the location where the measurement instrument is installed, it might reflect erroneous claim values. The first problem could be solved by using complex models. However there is always a trade-off between the complexity and comprehensibility of the product, as most of WIBI schemes are directed towards farmers who might not be highly educated. The second problem could be solved by having dense network of weather measurement instrument in the sales area of insurance. However this might not be affordable for a single insurer and thus donor support could be required. One more way to handle basis risk is to design

[3] This issue is known as adverse selection in insurance terms.

insurance products based on vegetative index or any other alternative indices, which are better predictors of the losses. However, insurance schemes based on such indices are yet to see scaled markets due to high capital costs associated with their designing.

We have tried to take into consideration most of these challenges before making definite recommendations in this report.

3 Description of the Priority Areas

Before discussing about the feasibility of designing specific index products for the areas under CCAP, it would be essential to first understand in detail about the terrain, livelihoods and key risks in the priority areas.

3.1 Demographics

Whereas most of the population of Buenavista stays in urban settlements, most population of Las Nieves stays in rural areas. Still, due to the large geographic area available, highest number of families dependent on farming in Buenavista.

Municipality/City	Rural population	Urban population	Number Of Families Dependent On Farming
Buenavista	36023	17036	4,768
Jabonga	19414	3638	3,527
Las Nieves	23961	1241	3,669
RTR	10494	4482	1,946

Source: Socio-Economic Profile-AdN(2005) and NSO (2007)

3.2 Land profile

Total land area covered by each municipality is given below:

Municipality	Area (hectares)	Area under agriculture (hectares)	% area under agriculture	Agricultural Soil Types
Buenavista	47,561	9,175.30	19.29	Camansa Clay Loam, San Miguel Clay Loam, Isabela Loam/Buguey Loamy Sand
Jabonga	29,300	9,589	32.73	Kicharao silt loam, clay loam
Las Nieves	58,269	7,833.84	13.44	Camansa Clay Loam, San Manuel Clay Loam
RTR	7,915	4,945	62.48	Butuan/San Miguel Loam, Malalag Silt Loam, Mountain Soil(Rubble Land)

Source: Provincial Planning and Development Office, Agusan del Norte (2009)

We can clearly see that agricultural area in Las Nieves is smallest in proportion, due to large forest lands. Same holds true for Buenavista where agriculture is concentrated in low lying areas. In RTR too, agriculture is concentrated in low lying areas, but land available for agriculture is greater in proportion. Naturally per-capita land available is higher in RTR than any other municipality and income from farming per household seems higher.

The municipalities have access to different water resources. A municipality wise summary is given below:

Municipality	Water Resource
Buenavista	Cabalalahan River, Gihao-an River, and Kiagta River
Jabonga	Baleguian River and Calinawan River, Lake Mainit
RTR	Cabadbaran River
Las Nieves	Magos River, Katipunan River, Marcos Calo River and Lingayao River

Source: Compiled from Baseline Study, ILO CCAP

3.3 Weather

PAGASA has divided Philippines into four distinct climate zones[4]. Accordingly, all the four municipalities exhibit **Type 4** climate, characterized by no distinct dry season. The period from March to August is called as 'wet season' whereas September to February is known as 'very wet season'. The municipality of Jabonga is situated almost on the border of the Type 4 and Type 2 weather zones. Type 2 weather zone is characterized by 'no dry season with very prominent rainfall between December and February'. Due to prominent rainfall in the 'very wet season', there have been several historical instances of flooding particularly in the months of January and February. Except Jabonga, no other municipality is in typhoon belt. However all these municipalities receive heavy rainfall in case of occurrence of typhoons in the nearby areas. Jabonga, on the other hand, has experienced five supertyphoons in the years between 1964 and 1994. It is exposed to seven percent of the typhoons hitting the country.

3.4 Livelihoods

Most of the population in rural barangays[5] is involved in agriculture. Rearing livestock[6], fisheries and running sari-sari store[7] are popular supplementary sources of livelihood. Key crops taken in the priority areas are shown below:

Municipality	Major crops
Buenavista	Rice, coconut, banana and corn with some vegetable and root-crops
RTR	Rice, coconut, banana
Jabonga	Rice, coconut, banana, corn, squash
Las Nieves	Rice, corn, coconut, banana, coffee

Source: Compiled from Value Chain Analysis and Baseline Study of ILO CCAP

Cropping seasons of the major cereal crops like rice and corn are somewhat synchronized with wet and very wet climatic seasons. Rice is grown in the windows of May to September and November to March whereas corn is grown from January to May and July to November.

Though a detailed data on the share of each source of income source is not available, it could safely be assumed that the income is well diversified in case of most of the farmers.

[4] http://kidlat.pagasa.dost.gov.ph/cab/climate.htm

[5] Barangay is a local Filipino term for 'village'. In the administrative hierarchy, several Barangays make up a municipality or a city. Several municipalities make a province whereas several provinces make a region.

[6] Mainly swine and poultry farming. A few people are also involved in raising carabao/other cattle, duck farming, goat and sheep farming etc.

[7] Petty shop

3.5 Financial institutions

While assessing the feasibility of introducing innovative financing products under CCAP, need was felt to locate best possible intermediaries having a prior experience of offering financial services. Hence a brief profiling study of the key financial institutions was carried out by DTI (focusing on lending institutions) and DOLE (focusing on insurance schemes) assisted by the Microinsurance Fellow. We shall briefly discuss the findings of the study here.

Most of the farmers in the CCAP area are dependent on individual agriculture traders for supply chain support. These traders, apart from buying the agricultural produce from the farmers, give informal credit to take care of the expenses on agri-inputs. Typically the interest rates for these loans are much higher than the formal loans. On the formal credit providers' front, though there are banks, cooperatives and NGOs existing in the province, very few have interactions with the farmers in the priority municipalities. Interestingly, as per our discussions with Land Bank, which is a specialized government bank specifically incorporated to focus on agriculture lending, it does not have any tie-up with any lender having existing retail (individual) agriculture loan portfolio in any of the priority areas. That left us focusing on cooperatives and banks which are not much dependent on Land Bank for provision of credit. People's Bank of Caraga, CARD Inc, Enterprise Bank and BAUG Cooperative were found to be active lenders in the priority areas.

In the context of agriculture lending by non-banking institutions, the case of agri-financing by LGU of RTR is worth mentioning. Under the nationwide One Town One Product (OTOP) Programme, LGU of RTR has focused and promoted production of organic rice since 2005. For this, the LGU supports organic rice farmers with loans bundled with life and crop insurance underwritten by PCIC. A distinct feature of these loans is that they are collateral free and in case of defaults, all other farmers in the same barangay are refused loans in the next agricultural season. This creates an immense social pressure on the farmers to repay the loans. Till date, there have been no cases of defaults under this scheme.

On macro-level, the municipalities receive credit from Land Bank (and any other sources) for infrastructure development.

3.6 Risk faced by farmers

Risks faced by farmers could be divided in two parts:

1. Production risks

The Vulnerability and Adaptation Assessment Report describes the agricultural production risks of priority areas in detail. We will try to summarize its findings in this subsection.

	Buenavista	Las Nieves	RTR	Jabonga
Typhoon			2009	1964, 1984, 1985, 1993, 1994
Flood	2003, 2005, 2006, 2007, 2008, 2009	1999, 2002, 2006, 2008, 2009	2003, 2005, 2006, 2007, 2009	1980, 1985, 1986, 1993, 1996, 2006, 2008
Drought	2003, 2004, 2005, 2006, 2009	2002, 2003, 2009	Does not affect much. Most of the	1983

			area is irrigated.	
Earthquake				1978

Due to availability of sufficient irrigation supply, RTR is not affected by droughts, but many of its barangays are affected during floods. The records above also give a picture about availability of data on past calamities. Whereas in case of Jabonga, a very long series of data is available, the same is not true for other municipalities.

Apart from these pest attacks and crop diseases are also prevalent, particularly in RTR and Buenavista, causing production losses though the government arranges several training programmes to make farmers aware about pest management.

Continuous rainfall sometimes leads to water logging and spread of diseases, which affect livestock productivity.

2. Price risk

The table below shows post harvest facilities available in the priority areas. Interestingly, RTR and Jabonga which have easy access to the national highway, lack substantially in basic output processing facilities. The functioning of agricultural cooperatives or organized granaries is very limited in all the four municipalities and virtually no procurement occurs through them. Naturally, farmers rely on individual private traders to sell their outputs in unprocessed form, who end up making 50 to 100 percent profit in trading. As mentioned above, apart from procuring the produce, these traders also provide informal loans to farmers and thus in a way cover entire supply chain.

Municipality	Types of Facilities				
	Threshing / Shelling	Drying	Milling	Warehouse / Storage	Total
Buenavista	49	29	13	11	102
Jabonga	4	28	5	3	40
Las Nieves	54	21	13	-	88
R.T. Romualdes	2	19	6	1	28

Source: Post Harvest Facilities Development Plan 2006

4 State of current risk management solutions in the proposed region

In this chapter, we will take a look at the available insurance services and other risk management practices in the priority areas.

4.1 Insurance

4.1.1 Life insurance

Life insurance schemes are mostly tied up with formal loans. Notable underwriters include PCIC, CLIMBS, Pioneer Life and CARD MBA etc. Informal insurance schemes covering funeral expenses through barangay level societies are popular, particularly in Las Nieves. Stand-alone life insurance products have very low penetration in the area.

4.1.2 Agriculture insurance

Except for RTR, where the LGU programme gives insured loans for agriculture, PCIC does not have much presence in the priority municipalities[8]. This could probably be attributed to the absence of existence of credible distribution mechanism. In the case of Jabonga and Buenavista, PCIC has tied up with the municipal livestock dispersal programme to offer livestock insurance to the farmers. As the feasibility study is specifically focused on agriculture insurance products, we will discuss the prevalent insurance rates in the region.

Borrowing farmer									
Multi risk cover					Natural disaster cover				
	Palay		Corn			Palay		Corn	
	Wet	Dry	Phase A[9]	Phase B		Wet	Dry	Phase A	Phase B
Farmer	5.97	4.35	4.37	9.25	Farmer	2.5	2.03	2.92	7.72
LI	2.34	1.7	2.07	4.38	LI	1.67	1.35	1.21	3.2
Govt	7.95	5.79	5.96	12.61	Govt	3.91	1.35	3.93	10.4
Total	**16.26**	**11.84**	**12.4**	**26.24**	**Total**	**8.08**	**4.73**	**8.06**	**21.32**
Self financed farmers									
Multi risk cover					Natural disaster cover				
	Palay		Corn			Palay		Corn	
	Wet	Dry	Phase A	Phase B		Wet	Dry	Phase A	Phase B
Farmer	8.31	6.05	6.44	13.63	Farmer	4.17	3.38	4.13	10.92
Govt.	7.95	5.79	5.96	12.61	Govt.	3.91	3.17	3.93	10.4
Total	**16.26**	**11.84**	**12.4**	**26.24**	**Total**	**8.08**	**6.55**	**8.06**	**21.32**

We can see that total premium goes as high as 26.24 percent in case of Phase B of corn crop, which indicates full payouts in one out of four years. On the other hand, natural disaster cover for Palay is charged at only 8.08 percent, which indicates full payouts in one out of twelve seasons (considering no payouts in other seasons).

One more point to be noted is that the lending institution shares some portion of the premium in case of loan-linked insurance, rather than receiving any agency fees. This makes sure that the lender pays for the indirect benefits arising from reduced bad debt in case of crop failure.

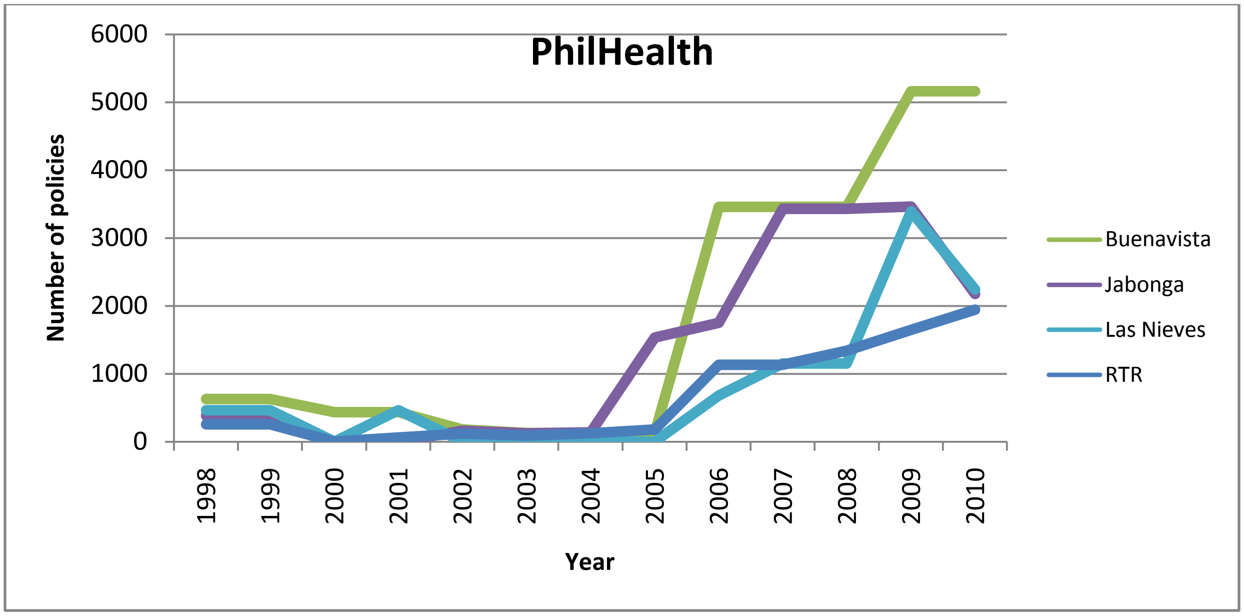
4.1.3 Health Insurance

In terms of penetration, Philhealth[10] clearly stands out among all the insurance products. The growth of the outreach could be judged from the graph below.

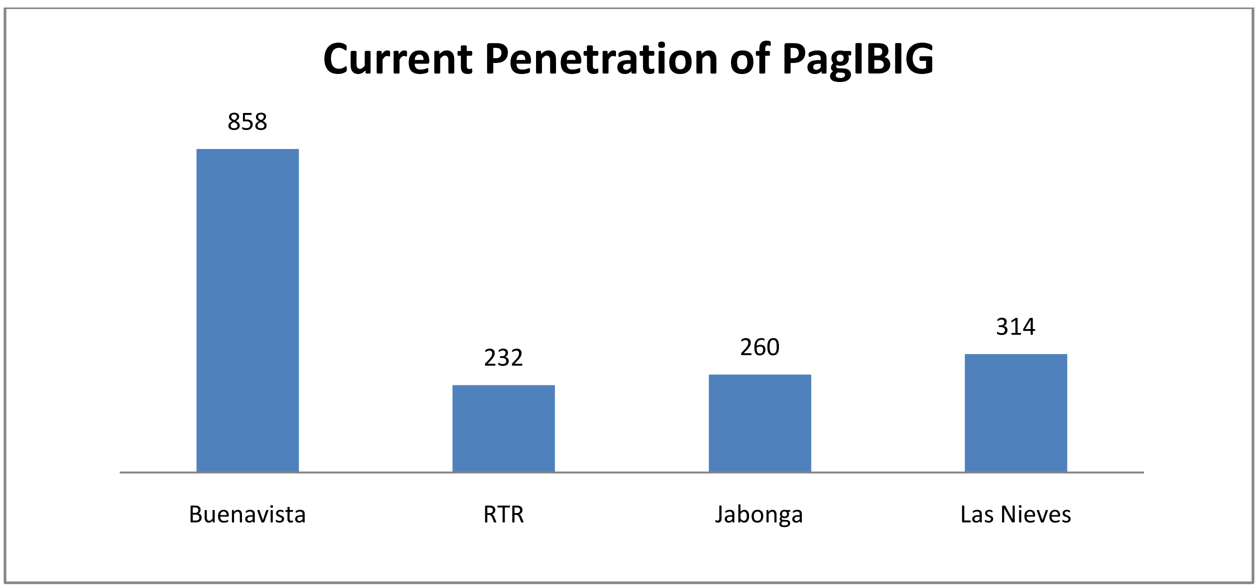
[8] It must be noted that agriculture insurance in Philippines is currently being underwritten only by PCIC.

[9] Phase A indicates crop in the first semester (January to May) whereas Phase B indicates crop in the second semester (July to November).

[10] Philhealth stands for Philippines Health Insurance Corporation. It is Philippine Government's flagship insurance programme and is operated at national level.



Source: Local PhilHealth Office



4.2 Pension and other social security plans

Social security schemes like Pag-IBIG[11], GSIS[12] and SSS[13] too have some presence, though clearly not as much as Philhealth. All these three schemes have different objective. PagIBIG offers a facility of long term savings and also allows the members to avail housing related facilities. GSIS can cover only government employees whereas SSS can cover private sector employees.

[11] Pag-IBIG stands for Pagtutulungan sa Kinabukasan: Ikaw, Bangko, Industria at Gobyerno. It is a national level savings programme targeted towards informal sector, with an objective to provide affordable housing to them.

[12] GSIS stands for Government Service Insurance Scheme. It is a pension fund for the government employees.

[13] SSS stands for Social Security Scheme. In simple words, this could be thought of as a counterpart of GSIS, but targeted specifically towards private sector.

4.3 Agriculture Guarantee Fund Pool (AGFP)

Chiefly contributed by Land Bank and other government agencies, AGFP is created to provide guarantee to unsecured agricultural loans to smaller farmers in Philippines. The pool is envisaged to encourage credit institutions to increase lending to these farmers in the future. Though the pool does not give any direct benefits to the farmers (unlike agriculture insurance), it helps reducing the burden on the lending institutions in bad years. However, it should be noted that AGFP compensates the losses or defaults recorded by the lending institutions in short term, but expects them to 'repay' the compensation in the end. Further, bad debt due to any possible reason is eligible for the compensation, unlike insurance claims, where only definite perils mentioned in the policy are liable to claims.

4.4 Contingency Funds

From the meetings with the municipality officials, it is understood that each municipality is mandated to keep aside five percent of its estimated revenue as *annual lump sum appropriations for relief, rehabilitation, reconstruction and other works or services in connection with calamities which may occur during the budget year.*[14] Further the law also states that:

"The calamity fund may also be utilized for undertaking disaster preparedness activities and measures, provided that the sanggunian concerned shall declare an imminent danger of the calamity".

And,

"Any unexpected balance of the calamity fund at the end of the current year shall revert to the un-appropriated Surplus for re-appropriation during the succeeding budget year".

Thus it is clear that there is a definite legal provision to ensure partial allocation of annual fund at municipality level for calamity contingency.

4.5 Ex-post techniques

From baseline survey, it can be concluded that though some forms of formal insurance packages are available in the priority area, their purchase is constrained by liquidity, thus affecting penetration of most of the insurance products. Further, it is also clear that few farmers resort to informal ex-ante risk management mechanisms like diversification of income sources, growing calamity resistant crop varieties etc. to manage agricultural risks. However, most of the farmers rely on ex-post mechanisms to manage their farm risks. The key strategies include:

1. Accessing distress loans
2. Shifting to labour employment or any other semi-skilled/unskilled jobs like carpentry, peddling etc.

5 Product feasibility

Availability of long term and high resolution weather data, yield data and building dependable distribution process are some of the key factors to be able to implement WIBI successfully in the given region. Apart from this, insurance regulations, knowledge of insurance among end customers and capacity of intermediaries and insurer could also play critical role. We will discuss about all these aspects in this chapter.

[14] Section 324 (d) of Republic Act No. 7160

5.1 Analysis of weather data availability and validity

The picture in Annexure 1 shows the only synoptic weather station available in the project area to date. This weather station is situated at Butuan Bancasi Airport and is maintained by PAGASA. Thirty year historical data (starting 1981) from this weather station has been obtained by CCAP. A quick analysis shows that among the total 10835 days rainfall data is unavailable for 875 days (or 8.075 percent values are missing). Particularly, since 2001, 247 values are missing. Apart from the synoptic station, there is one weather station installed in the campus of PhilRice, in RTR. There are also a few raingauges available in some of the municipalities. However data from these sources is not readily available.

The circle shown in the picture shows the area covered within a radius of 20 km around this station (approximately). We see that municipalities of RTR and Buenavista are partially covered in this circle. However Jabonga and Las Nieves are quite far from the station, necessitating installation of weather stations if WIBI is pursued. To this end, CCAP took it upon itself to access support from the Department of Science and Technology –Caraga Regional Office for the installation of the needed weather stations (under their collaboration for the establishment of Early Warning Systems in these area). The instruments shall be installed in 2011. Thus, it is clear that the WIBI products in CCAP can't be launched in all the municipalities initially. Instead, a phased approach would be advisable, with the first phase in Buenavista and RTR, and possibly a second phase product in Jabonga and Las Nieves. Weather data can be collected in Jabonga and Las Nieves, from newly-installed weather stations by DOST during the May-November 2011 cropping period which can support possible development of a similar product in the second phase.

The table below captures the exact nature of the instruments.

Municipality	Current infrastructure	Planned infrastructure in 2011
RTR	Few rain gauges. Synoptic weather station at Butuan Airport	Manual rain gauges, weather station and water gauges
Buenavista	Few rain gauges. Synoptic weather station at Butuan airport	Water gauge, manual and digital rain gauges
Jabonga	Few rain gauges. No synoptic weather station available in nearby area (20 km range)	Water gauge, manual and digital rain gauges
Las Nieves	Few rain gauges. No synoptic weather station available in nearby area (20 km range)	Water gauge, manual and digital rain gauges

Regional office of DA also made available spatially interpolated rainfall estimation data from NASA for all four municipalities. However this data is available from 1997. We tried to use correlation analysis to understand the feasibility of using this data for filling up missing data values of Butuan weather station through inverse distance method.

Table below shows the correlation of dekadal rainfall among three data sets: spatial NASA rainfall data of RTR, spatial NASA rainfall data of Buenavista and point-based (ground weather station based) rainfall data of Butuan Airport[15]. We see that though Buenavista and RTR data has high correlation between themselves (perhaps due to same source), same does not hold true for correlation with Butuan data. Still, significant positive correlation is visible.

Dekadal Analysis	Sum of Spatial RTR	Sum of Spatial Buenavista	Sum of Actual Butuan
Sum of Spatial RTR	1		
Sum of Spatial Buena Vista	0.795588008	1	
Sum of Actual Butuan	0.187132391	0.229652405	1

The correlation becomes slightly better in case of monthly analysis.

Monthly Analysis	Sum of Spatial RTR	Sum of Spatial Buenavista	Sum of Actual Butuan
Sum of Spatial RTR	1		
Sum of Spatial Buena Vista	0.808791247	1	
Sum of Actual Butuan	0.216504347	0.307464382	1

Considering the correlations above, we have filled up the missing data values from the available spatial rainfall data of RTR and Buenavista, using inverse distance method.

5.2 Choosing among micro, meso and macro policies

There could be three different levels at which WIBI contracts could be designed. For simplicity, we will call them micro, meso and macro level products.

Level	Insurable Unit	Pros	Cons
Micro	Farmers	Highest level of accountability at bottom level. Direct impact.	Efforts in education, Higher basis risk, Complex crop modeling
Meso	Aggregators/mediators like banks	Low basis risk. Indirect trickle-down effect. Encourages business continuation. Easier to train.	Absence of such organizations in most Barangays[16]. Trickle down is not always ensured.
Macro	Municipalities	Low basis risk Best possible distribution Easier to train	Challenge of estimating loss data Possible misuse of payouts

[15] Only Buenavista and RTR datasets are used as these municipalities are nearest to the synoptic weather station of Butuan City.

[16] Though Farmers Associations and Irrigators Associations are present, apparently they are not strong enough to act as distribution agents.

All the possibilities were discussed with the implementing partners of CCAP and the insurer thoroughly. While macro level cover looks interesting, it is currently not possible for PCIC to insure such entity, as its charter compels it to underwrite exclusively agricultural risks. In case such entities are insured, the use of claim amount would be a matter of their own discretion and most of the municipalities would end up using this money in relief and rehabilitation work, not exclusively focusing on agricultural sector. This would be against the PCIC's charter. Nonetheless such insurance designing is quite possible in case any other insurer is willing to underwrite such risk. In fact, as described already, each municipality has a definite provision of putting aside contingent funds from the budget every year and partial – if not all – of such funds could be used to pay the premiums to the insurer, rather than self-insuring the future risks. Though such insurance has been tried successfully at multi-national level by Caribbean countries[17], any instance of such arrangement at municipal level is unknown.

Given the constraint of PCIC to underwrite purely agricultural risks, and given that no notable meso-level partners could be found (except for the RTR LGU's OTOP Programme), we conclude that **only micro level index insurance would be possible currently.** These insurance schemes would be crop specific and hence would involve in-depth study of crop risks.

5.3 Crops and crop parameters

It is not easy to cover all the crops mentioned earlier in the priority municipalities under WIBI. Particularly, estimating yield loss for perennial crops due to poor weather is difficult. In case of irrigated crops, defining water stress remains challenge. After analyzing various crops taken in the priority area, we found it feasible to focus on rice and corn for WIBI. We tried to understand the cropping patterns of both of these in detail.

5.3.1 Rice

Majority of the rice production in Philippines is taken in two seasons:

- Wet season: from March to September
- Dry season: from September to March

But in case of Agusan del Norte, the seasons exactly reverse, due to pronounced rainfall in the months of December, January and February. The cropping seasons for rice here are:

- Wet season: from March to September
- Very wet season: from September to March

As stated before, due to very wet season in these two of the months, flooding is a major concern. Thus some municipalities are promoting submerged rice varieties to cope up with water inundation. Early, medium as well as late maturity varieties are sown in all the municipalities, but the most popular is medium maturity variety, with total cropping cycle of 115 to 120 days. Cropping calendars of all the four municipalities do not perfectly overlap. In RTR and Buenavista, second season is from later part of October or early November to May whereas in Las Nieves and Jabonga, rice sowing starts in the later

[17] The arrangement is known as Caribbean Catastrophe Risk Insurance Facility (CCRIF) and insures earthquakes and hurricanes.

part of December and is harvested in May. Further, across municipalities, irrigation status varies. An approximate picture is given in the table below:

Municipality	Irrigation
Las Nieves	Rain fed
RTR	Mostly irrigated
Buenavista	Rain fed as well as irrigated
Jabonga	Rain fed as well as irrigated

The table below describes various phases of rice crop and key risks faced:

Phase	Early Maturity	Late Maturity	Risk faced
Pre planting	30	30	
Vegetative	45	65	CD, ER
Reproductive stage	30	30	CD, CR
Maturity	30	30	ER, CR
Total	135	155	

Note: CD = Continuous dry days, ER = Excess rainfall, CR = Continuous rainy days

5.3.2 Corn

There are chiefly two varieties of corn grown in the priority area: White corn and Yellow corn. Indigenous, OPV and hybrid types of seeds are available for white corn whereas only hybrid and indigenous seeds are available for yellow corn. Approximate ratio of land under non hybrid types to hybrid types is 2:1. OPV and indigenous crops have shorter roots and are known to be less tolerant to weather shocks as compared to hybrid. Municipality wise distribution of these varieties in CCAP priority area is given below:

Municipality	Variety
Buenavista	White corn. Usually OPV.
Las Nieves	Yellow corn. Usually hybrid.
RTR	White corn. Usually OPV.
Jabonga	White corn. OPV as well as Hybrid.

As described earlier, there are two seasons in which the crop is grown: Semester 1 and Semester 2. Corn in semester 1 is grown in January/February and is harvested by June whereas semester 2 starts in July/August and ends by November. Most of the corn is rainfed and thus the sowing depends on onset of rainy period. A dekadal rainfall of 35 mm to 45 mm is necessary to start sowing. Though most of the times there is sufficient rain in the beginning of Semester 1, this factor becomes crucial in the Second semester, as July and August are relatively dry months. If there are no rains by August end, farmers might have to skip the whole cropping period to avoid heavy rains during harvesting, which could occur in December (if the crops are sown after late August).

Table below explains various phases of crop development, the number of days associated with each phase and key risks faced by the crop in those phases.

Broad phase	Stage	Number of days		Key risks faced	
		Semester 1	Semester 2	Semester 1	Semester 2

Planting and establishment	Germination	5	6	ER	LR
	Leaf development	5	6	ER	LR
Vegetative	Stem elongation	15-20	20-25	LR	LR
Flowering	Inflorescence emerging, heading	15	20	LR	LR
	Flowering, anthesis	10	10	LR	LR
Maturity	Development of fruit	15	15	-	ER
	Ripening	30	30	-	ER
	Total	100	107-110		

LR = Low rainfall, ER = Excessive rainfall

Semester 1 has more rainfall in the planting phase which causes faster growth of the crop in the first phase as compared to the growth in Semester 2.

5.3.3 Reference Evapotranspiration

Unfortunately, reference evapotranspiration values were not available for local conditions. Hence based on historical temperature and humidity data, we tried to find average evapotranspiration values for the areas surrounding Butuan City Airport. The table below shows these values produced from ET Calculator of FAO. The values hold good for dekads starting with the shown dates, and thus have unit as mm per dekad or mm per ten days.

Dekad start date	1-Jan	2-Jan	3-Jan	1-Jul	2-Jul	3-Jul
Reference ET	33.1	33.9	35	45.2	45	46.1
Dekad start date	1-Feb	2-Feb	3-Feb	1-Aug	2-Aug	3-Aug
Reference ET	36.2	38.6	41.3	46.5	46.7	47.9
Dekad start date	1-Mar	2-Mar	3-Mar	1-Sep	2-Sep	3-Sep
Reference ET	42.2	44.6	46.2	46.6	46.7	45.7
Dekad start date	1-Apr	2-Apr	3-Apr	1-Oct	2-Oct	3-Oct
Reference ET	48.8	49.6	49.7	44.2	42.5	42.1
Dekad start date	1-May	2-May	3-May	1-Nov	2-Nov	3-Nov
Reference ET	48.7	48.1	48.2	39.9	37.4	36.3
Dekad start date	1-Jun	2-Jun	3-Jun	1-Dec	2-Dec	3-Dec
Reference ET	47.7	45.2	44.7	35.3	34.1	34.4

5.3.4 Crop coefficients and yield coefficients for corn and rice

Crop coefficients (Kc) and yield factor (Ky) values were taken as per the standard FAO guidelines. Kc values were adjusted for humidity and wind speed values noted at Butuan Airport. Kc values for rice and corn are as follows:

Phase	Kc for rice	Ky for rice	Kc for corn	Ky for corn
Sowing	1.05	1	0.35	0.40
Vegetative	1.05	1.09	0.725	0.40
Reproductive	1.05	1.09	1.075	1.3

Maturity	1	1.09	0.8	0.5

It should be noted that all these parameters are applicable for drought insurance. For excess insurance policies, local knowledge was used to develop loss parameters.

5.4 Analysis of crop yield loss data availability and validity

To test the index, it is essential to know crop losses due to different perils in the past years. If such data is available, it could be viewed as against the theoretical yield loss obtained from weather index based crop models to see if their values are similar. If a good match is obtained, one can safely conclude that the developed index is a good proxy for yield loss. There could be two different reasons if a good match is not seen: either the real yield data might have errors, or the model itself needs to be modified. However to analyze this, a sufficiently long yield data and weather data must be present. Further, it should be noted that yield data must be of same resolution as the weather data. **In most of the cases, this would mean that the yield data should be obtained from the locations nearby the weather station.**

Unfortunately municipality wise and season wise disaggregated data is available for only past five years in the priority areas – and that too for only a few municipalities[18]. Seventeen years (from 1994) of yield data is available at province level from the regional office of Bureau of Agriculture Statistics. This is provided in the Annexure. We also tried to refer to the records of PCIC. However, seasonal disaggregated data could not be found at the provincial level. The data is divided as flood losses, drought losses, pest and disease losses, which might give some idea about payouts in the wet season due to drought and in the very-wet season due to floods.

	Flood/Typhoon	**Drought**	**Pests**	**Diseases**
2001	1218.43	3682.897	2345.229	2241.606
2002	1289.61	4371.543	2174.307	1632.067
2003	1830.783	3480.864	2489.533	461.5401
2004				
2005				
2006	2476.481		2440.233	2352
2007	2148.966		1611.838	1960.941
2008	3008.045		1496.804	1333.9
2009	2796.542	3324.462	2033.41	1780.319
Average	**2109.837**	**3714.941**	**2084.479**	**1680.339**

[18] The individual municipality-wise yield data is captured in the Vulnerability and Adaptation Assessment reports.

We clearly see that though per hectare payments of drought have highest value, the payouts for other risks such as flood, pests and diseases can't be ignored. Discussions with the local agriculturists also stressed that rather than drought in the months of July to September, most of the priority areas are more vulnerable to floods in December to February. In RTR, most of the palay is vulnerable to pests and diseases, and in particular stem-borer attack. Due to irrigated agriculture, farmers from RTR do not face drought risk much, unlike the farmers in Buenavista where a mixture of both irrigated as well as rain fed crops is found.

The analysis above suggests that the availability of granular data at the municipality level is limited and testing of the weather indices would be approximate in nature. Further, an index capturing low probability-high severity events would be easier to build in this set up rather than an index capturing high probability-low severity events.

Yearly records of floods, droughts and typhoons are available only for last ten years for three of the individual municipalities (as discussed in the earlier section). This data is given in the Annexure. Dates of major floods in Caraga region and Butuan City were made available by OCD (given in Annexure for Butuan City, as the weather station is in Butuan City), which was extremely useful to decide trigger values for excess rainfall policies. We will try to analyze the per-hectare payouts for various risks below based on this data.

5.5 Review of literature on schemes in similar areas

Unlike most of the other pilots where WIBI has been chiefly launched to mitigate risks faced by rain fed crops, we see that the crops in CCAP area face risk not only from scarcity of rainfall but also from floods occurring due to excessive rainfall and pests and diseases. Thus a direct application of FAO guidelines on crop water stress analysis might not be sufficient to design WIBI policies in this terrain. Approximate models for simulating losses due to heavy rainfall will have to be used while designing a comprehensive cover.

We will first look at some of the relevant Asian case studies where index based projects are piloted.

The nearest areas where WIBI policies have been tried out for corn are Thailand and Indonesia. Further, a flood insurance policy was piloted in Vietnam. In all of these countries, the efforts are still in the pilot or developmental phase. Sompo Japan Insurance Company has launched drought insurance for rice crop in Northeast Thailand in January 2010 based on the feasibility study conducted by Japan Bank for International Cooperation in 2007. Stoppa and Manuamorn (2010) discuss about feasibility of launching WIBI policies for corn crop in East Lombok and South Sulawesi in Indonesia where there is lack of irrigation infrastructure and easy access of agricultural risk management tools. While they conclude that it is technically feasible to launch WIBI policies in the given areas, they also clarify that index insurance might not itself be sufficient to improve the livelihoods of the farming community, unless basic infrastructure like lending institutions, road etc. is in place. Skees (2008) discusses a pilot flood insurance policy offered to Vietnam Bank for Agriculture and Rural Development (VBARD) in Dong Thap province of Vietnam. The nature of the policy was different than a typical microinsurance product. This insurance covered 'business interruption' losses of VBARD. Such mechanisms could be helpful in reducing the basis risk involved in the contracts. For example, in this case, if the farmers were individual customers of the policy, it would have been very difficult to adjust indices for individual cases, if the farmers were fragmented. But designing a meso-level policy could balance out differences in the payouts. However, the policy could be sold only for a single year period and VBARD chose not to buy it in the next year.

Apart from these Asian examples, study conducted in Mali for insuring portfolio of lenders[19] indicate that key for success of a meso-level insurance would depend on how well the claims trickle down to the borrowing farmers.

As stated earlier, excess rainfall cover has not been offered in most of the places. But India, Mexico and Nicaragua are some notable exceptions. Particularly in India, the insurance market for excess rainfall policies is quite developed. Most of the times these policies are bundled with drought index insurance so as to cover risks on both sides - low as well as excess rainfall. It should be noted that excess rainfall does not necessarily cause flooding or inundation, but can surely reduce quality as well as the quantity of the production in most of the phases of the crops.

6 Market assessment

In this chapter, we will discuss topics which are not directly related to WIBI design, but are rather related to other factors critical for implementation like marketing, sales and regulation.

6.1 Client education

The baseline study concludes that low uptake of crop insurance services could be attributed to low levels of awareness about products. In case of WIBI products, given that such products are completely unheard of, a comprehensive client education programme would be needed to ensure that the farmers understand the product features fully before they buy it. Particularly, following points need to be covered during the education campaign:

1. Risks faced by farmers and traditional mechanisms to manage them
2. Basic concept of probability and probable losses
3. Selection of best choice under probable conditions
4. Mechanism of insurance
5. Mechanism of WIBI vis a vis traditional indemnity policies and its merits
6. Demerits of WIBI
7. Details of WIBI policy features like premium, index, trigger, notional etc.
8. Exclusions under WIBI
9. Sales and claims related information for WIBI policy
10. Risk management of non-weather risks

6.2 Capacity assessment of insurer and aggregators

For any successful implementation of innovative insurance scheme, the insurer should have clear vision for the product line and should understand the benefits as well as the challenges in offering the product

[19] Guirkingker (2010), Index Insurance Innovation Initiative (I4) Scientific Committee Meeting

to masses. In the current case, the higher as well as the middle management of PCIC (regional level) are found to be well aware of the facts about WIBI schemes and were found enthusiastic about the pilot. The insurer is clearly keen to develop strategies to think beyond the traditional indemnity based insurance packages and is treating WIBI as only one of the options. PCIC is also planning to pilot Area Yield Index Insurance and believes that the comparative results and experiences from both these pilots would guide the company strategy in the coming years.

Representatives from RTR LGU, one of the possible aggregators, feel that WIBI would be beneficial for their farmers due to potential speedy settlements. They are also keen to purchase meso-level WIBI policy, whereby instead of individual farmers, their whole loan portfolio could be covered against bad weather and the individual loan waivers would then be upon the LGU's discretion.

People's Bank of Caraga and BAUG Cooperative, which could be other potential intermediaries also responded positively to the concept.

6.3 Regulatory environment

As mentioned in the introduction, WIBI policies are actually forms of derivatives. Thus it becomes crucial to assess the insurance regulatory environment of any country trying such products. Interestingly PCIC is not governed by general insurance regulations set by Philippines' Insurance Commission (IC). Instead, it is guided by its own board of directors. However, to ensure that WIBI could be underwritten by private insurers in the future, it would be advisable to study the acceptability of such products by the regulator. There have been two prior instances of WIBI policies in Philippines. They are noted below:

1. Malayan Insurance Company, in partnership with Microensure had underwritten parametric typhoon insurance policies for a pilot region.
2. Recently, Munich Re has initiated a project in partnership with GTZ and CLIMBS for underwriting meso-level parametric cover and has expressed desire to scale the operations nationwide.

Clearly, the insurance regulations allow such policies to be underwritten in Philippines. Of course the regulatory requirement might vary from the requirements preferred by the directors of PCIC.

7 Recommendations

This chapter covers specific recommendations for the CCAP project. The 'Phased Approach' section might be helpful for devising long term strategy for insurers and mediators, even after the closure of CCAP, which is planned in December 2011.

7.1 Proposed nature of the contracts

Considering the risks faced by the major insurable crops, there could be three different types of covers offered under WIBI for both corn:

1. **Low rainfall cover:** This could be developed using a single phase or a double phase contract.
2. **Excess rainfall cover:** This could be developed using local knowledge. Though exact loss parameters are difficult to define, an approximate modeling could be possible. This policy could be useful particularly in the 'very wet' season, where there are recurrent floods due to heavy rainfall. Further

while designing this policy, frequent events (with full payouts in less than 5 to 6 years) should not be covered as flood is a high-frequency phenomenon in the CCAP area.

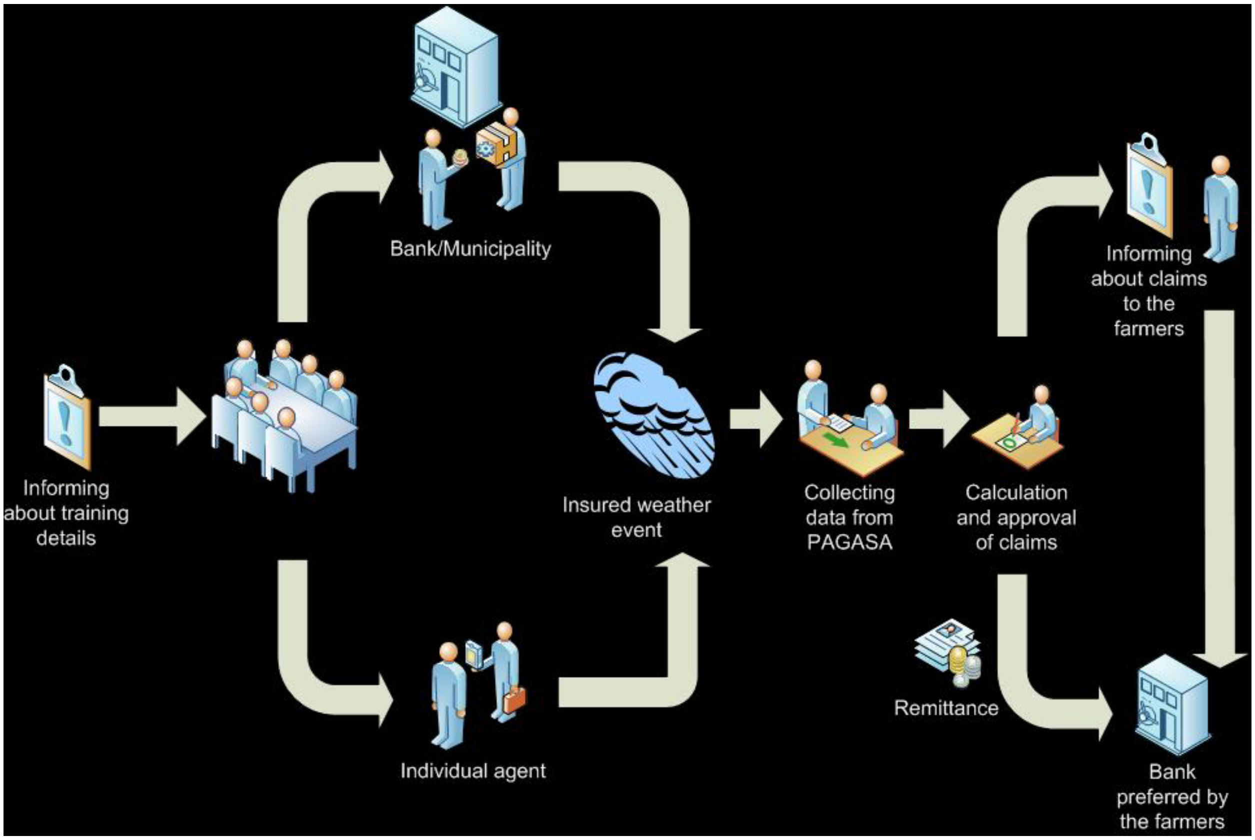
For rice, the products could be designed for drought and excess rainfall in case of rain fed farmers and for excess rainfall in case of irrigated farms. As per the inputs from the RTR municipality – which is chiefly irrigated – there has been almost no instance of issues due to drought due to consistently good irrigation.

We tried to find details on the correlation between onset of several diseases and weather. Though most of the diseases prevail in certain weather conditions, there has been no historical track of the events. Further, the exact weather conditions are not fully known and only approximate conditions could be gathered from the local agriculturists and etymologists. Hence it would be advisable to offer WIBI policies covering only against poor weather and not again pests. However the traditional pests and disease policies of PCIC could be sold along with WIBI.

A municipality wise summary of the possible products is given below:

Municipality	Crop	Crop variety	Irrigation	Product	Start date	End date
Buenavista	Rice	Late maturity as well as early maturity	Rainfed as well as irrigated	Excess rainfall, low rainfall	Mid May 2011	Late September 2011
Buenavista	Corn	White OPV	Rainfed	Excess rainfall, low rainfall, sowing failure	Early August 2011	Late November 2011
RTR	Rice	Late maturity as well as early maturity	Irrigated	Excess rainfall	Mid May 2011	Late September 2011

The process of sales and claims is depicted in the flow diagram below. Each sales activity would be preceded by training. Sales of both types of products - stand alone as well as credit linked - are captured in the diagram. In case of claims, the farmer would be informed by the insurer through the intermediary and the claim amount would be automatically credited to the preferred account of the farmer.



7.2 Pilot areas

Due to constraints posed by weather data, it would be advisable to start a pilot with areas nearest to the already existing synoptic weather station at Butuan Airport. Thus, the pilot product could be offered to some of the barangays of Buenavista and RTR, which have agricultural area within 20 km of radius from Butuan Airport.

The number of farmers to be covered per site could be decided based on the land area under the particular crops. In consideration of the planned financial literacy programme to be conducted in close coordination with local government units and concerned stakeholders, we assume that the uptake ratio of the insurance scheme will be approximately 40 percent, the total number of farmers to be insured will be 200, and the total number of farmer participants to the financial literacy programme would be 500. Keeping this as the benchmark, and working based on the proportion of the land under rice and corn in both the municipalities, the distribution of the farmers could be given as follows:

Municipality	Area under crops	Value in Hectares	Percentage contribution	Farmers to be educated	Value	Rounded value	Probable uptake	Rounded value
Buenavista	Corn	367	11.3019	Corn	56.51	57	22.8	23
Buenavista	Rice	1138	35.0527	Rice	175.3	175	70	70
RTR	Rice	1742	53.6454	Rice	268.2	268	107.2	107
	Total	3247		Total	500		Total	200

7.3 Feasibility of offering joint products

Given the credit constrained scenario, it would be advisable to sell WIBI with farm loans through formal lending institutions. Stand-alone product could also be sold by the same institutions. However commitment from a strong lending institution partner would be the most crucial factor for ensuring success of the pilot.

7.4 Phased approach

Though the sections above discuss about offering WIBI for second cropping season under CCAP in 2011 in select municipalities, the concept has potential for scale up in the other municipalities of CCAP in the future, given the plan of setting up new weather measurement infrastructure of the local governments. We will discuss a possible phased approach of offering WIBI products in all the municipalities under CCAP:

1. Given the lack of sufficient weather infrastructure in the current season, the policies could be underwritten based on Butuan City Airport weather station and could be sold in parts of Buenavista and RTR municipalities in second semester of 2011. However, assuming that at least some of the planned local weather infrastructure would be installed by the end of first semester of 2011, one can start recording the data on these stations. Once the data for a complete season is obtained, it could be studied and new contracts could be written based on the nearby weather stations where historical data is available (in this case Butuan Airport station).

Season	2011-1st	2011-2nd	2012-1st	2012-2nd	2013-1st	2013-2nd
Buenavista	Installing local weather-infra, Designing for 2nd season	Recording local weather, Product Sales, Designing for 1st season	Recording local weather, Product sales, Modification for 2nd season	Recording local weather, Product sales, Modification for 1st season	Recording local weather, Product sales, Modification for 2nd season	Recording local weather, Product sales, Modification for 1st season
RTR	Installing local weather-infra, Designing for 2nd season	Recording local weather, Product Sales, Designing for 1st season	Recording local weather, Product sales, Modification for 2nd season	Recording local weather, Product sales, Modification for 1st season	Recording local weather, Product sales, Modification for 2nd season	Recording local weather, Product sales, Modification for 1st season
Jabonga	Installing local weather-infra	Recording local weather	Recording local weather, Designing for 2nd season	Recording local weather, Product Sales, Designing for 1st season	Recording local weather, Product sales, Modification for 2nd season	Recording local weather, Product sales, Modification for 1st season
Las Nieves	Installing	Recording	Recording	Recording	Recording	Recording

	local weather-infra	local weather	local weather, Designing for 2nd season	local weather, Product Sales, Designing for 1st season	local weather, Product sales, Modification for 2nd season	local weather, Product sales, Modification for 1st season
Reference Weather Instruments	Not applicable	Butuan City Airport Synoptic Weather Station	Butuan City Airport Synoptic Weather Station	Local stations/ gauges	Local stations/ gauges	Local stations/ gauges

Note: Grey area indicates the current phase

2. Thus in case of the first season of 2012, the products could still be sold only in Buenavista and RTR based on the data from Butuan City airport, for the second semester of 2012, products based on local weather infrastructure could be launched in all the four municipalities.
3. Though a comprehensive plan for client education is needed in the first few iterations, it might not be commercially sustainable for the insurer. Hence gradually the intensity of the education programme could be reduced and a thin education module could be developed in the long term.
4. Further techniques like insurance games would be quite useful to be used at the meso-level to train the intermediaries in the long term.

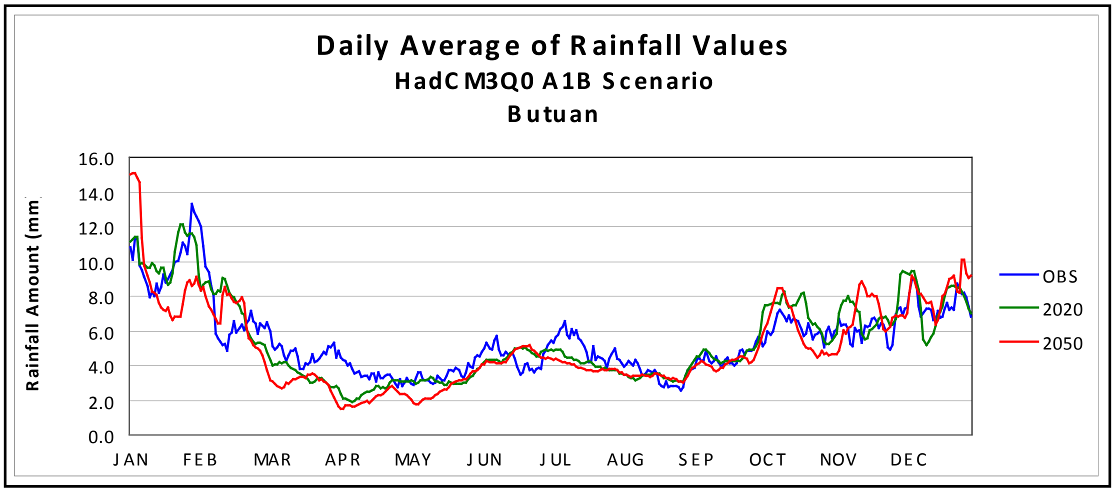
7.5 Incorporating Climate Change Scenarios from PAGASA

While logically WIBI appeals to the community working in the field of climate change adaptation, designers face several challenges in incorporating climate trends in the design of insurance products. Greene et al (2008)[20] mention about three different kind of climate change scenario analysis prevalent in the sector: long term, decadal and yearly. While long term trend analysis of the historical weather data could be easier to analyze and use in the pricing of index insurance, including the much more useful dekadal and yearly variability remains a feat yet to be achieved. The same paper also mentions two different approaches of incorporating climate change: one by allowing increasing variability in the claims using the same triggers and the other by maintaining the variability in the claims by dynamically adjusting the triggers analyzing weather data in a 'sliding window' of around thirty years.

Referring to scenario prediction of future weather trends could be helpful for designers as well as the insurance portfolio managers to get a sense of overall direction of long term losses. As insurance premiums are usually calculated for the immediate next sales season it might not be advisable to introduce the long term future trends in a single season. Rather, the gradual 'sliding window' approach mentioned above could be undertaken whereby the designers closely track the gradual changes in the weather parameters, refer to the already existing scenario predictions and continuously improve the pricing. In the current project, scenarios for average daily rainfall for the years 2020 and 2050 for Butuan City Airport Weather Station are readily being made available by PAGASA. Referring to this analysis, the vulnerability and adaptation assessment report under CCAP mentions that the daily rainfall trend across

[20] "Climate change – one decade at a time", Greene Arthur, Goddard Lisa, Ward Neil, Siebert Asher, Holthaus Eric, Hellmuth Molly, Baethgen Walter, IRI Workshop on Technical Issues in Index Insurance, 2008

the year would remain more or less same even in 2020. However in 2050, a moderate change is predicted with very high rainfall in an already-flood-prone month of January and lower than the current average rainfall in the months of April and May. As explained earlier, though the pricing would not include these distant scenarios directly, the insurance designers will have to keep a continuous track on the variability of rainfall in each season and adjust the trigger values accordingly.



Source: PAGASA (June 2010)

Further, PAGASA has also conducted scenario analysis for mean, minimum and maximum daily temperature for the years 2020 and 2050. This could be referred before designed temperature based weather index insurance contracts.

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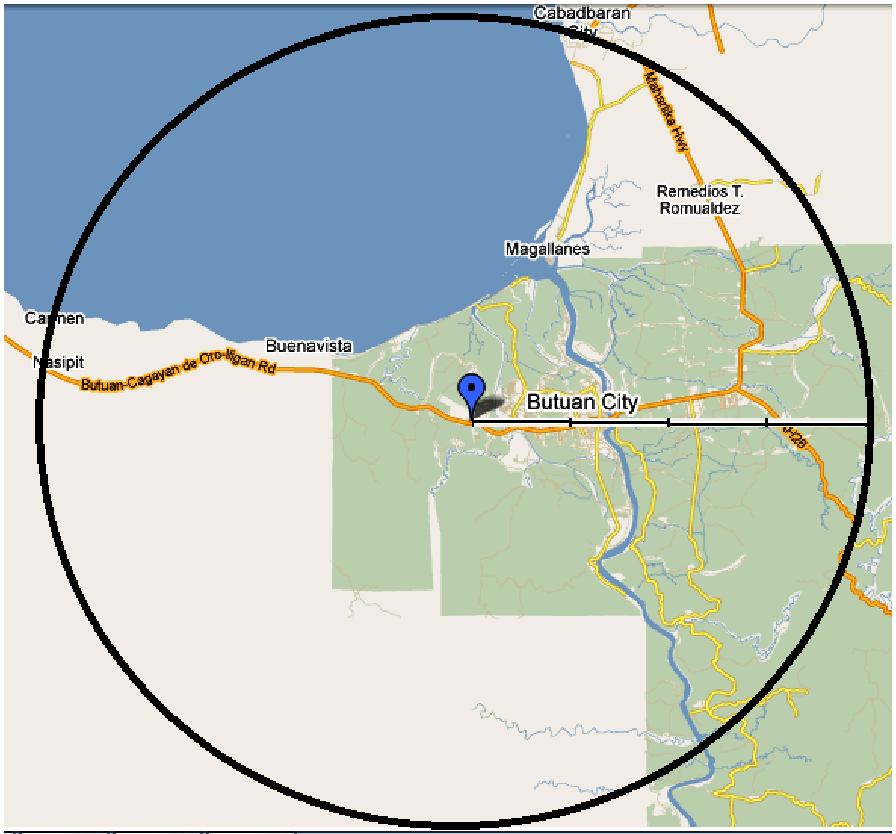
Annexure 1: Feasible areas that could be covered



Source: Google Maps

Annexure 2: CCAP priority municipality locations

Brief information about the municipality locations
Buenavista lies 9 degrees 55 minutes north latitude and 125 degrees 25 minutes east longitude of the northeastern part of Agusan del Norte. Its boundaries are Butuan Bay to the north; Nasipit to the west; Las Nieves to the south; and Butuan City to the east. The area is made up of plains and rolling lands. The northern portion is hilly while the southern part is flat. The Poblacion and most of the barangays are located along the plain. In its eastern boundary with Butuan City lies Mt. Mayapay. Remedios T. Romualdez (RTR) is 18.80 kilometers from Butuan City. Its boundaries are Cabadbaran to the north; Magallanes to the west; Butuan City to the south; Sibagat, Agusan del Sur to the east. The municipality is composed mainly of plains with the hilly part on the east and west. Jabonga lies within the grid of 9 degrees 18 minutes to 9 degrees 23 minutes north latitude and 125 degrees 24 minutes to 125 degrees 43 minutes east longitude. Its boundaries are Kitcharao and Surigao del Norte to the north; Butuan Bay to the west; Tubay and Santiago to the south; and Surigao del Sur to the east. It is 59.70 kilometers awa from Butuan City. The topography of the municipality is generally plain to rolling and hilly. Las Nieves is characterized by rolling hills and some flat lands. It lies 9 degrees north latitude and 125 degrees 30 minutes east longitude of the southern part of Agusan del Norte. Its boundaries are Butuan City to the north; Buenavista to the west; Esperanza, Agusan del Sur to the south; and Sibagat, Agusan del Sur to the east. It is 40 kilometers to Butuan City. Source: Baseline study, ILO CCAP, 2010

Las Nieves

Jabonga

RTR

Buenavista

Image Source: Wikipedia

Annexure 3: Input costs and income for corn and rice

Paddy cultivation expenses for Buenavista

Yield per hectare = 3,804.07 Kg

@ 80 sacks per harvest per hectare @ 50 kls per sack X 80 = 4,000 kg X P12.00/kg = P48,000.00

\- 44,760.00

==========

P 3,240.00 Net Income

Less:

Expenses for

a. Cultivation and planting = P15,000.00
b. Thresher = 8 sacks x 50 kls = 400 kls.xP12.00 = P4,800.00
c. Transportation @ P7 per sack x 80 = P560.00
d. Hauling @ P5.00 per sack x 80 = P400.00
e. Sharing = 20 sacks x 50 kls. X P12.00 = P12,000.00
f. Labor = P12,000.00

For Trader:

P 48,000.00 purchase of 4,000 kilos palay

Less: 10% drying reduction

3,600 kg	Expenses:
X .65% recovery	Milling fee = P50x46.8 = P3,276.00
==========	Labor = P5x46.8 = 234.00
2,340 kls	Sacks = P8x47 = 376.00
x P37	Transportation= P15x47 = 705.00
=========	Drying fee P5x72 = 360.00
P86,580 = Gross Income	=======
- 52,951.00	P4,951.00

= P33,629.00 Net Income

Rice Farmers = 4,377 Area: Irrigated – 826.50 has. Rain fed - 289.25 has.

Paddy cultivation expenses for RTR

Yield per hectare = 4000 Kg
@ 80 sacks per harvest per hectare
@ 50 kls per sack X 80 = 4,000 kls. X P12.00/kl = **P48,000.00**
Less:

Cultivation and planting =	P15,000.00
Threshers = 8 sacks x 50 kls = 400 kls.xP12.00 =	P 4,800.00
Transportation @ P7 per sack x 80 =	P 560.00
Hauling @ P5.00 per sack x 80 =	P 400.00
Sharing = 20 sacks x 50 kls. X P12.00 =	P12,000.00
Labor =	P12,000.00
	P44,760.00
	==========
Net Income	**P 3,240.00**

For Trader:
P 48,000.00 purchase of 4,000 kilos palay
Less: 10% drying reduction

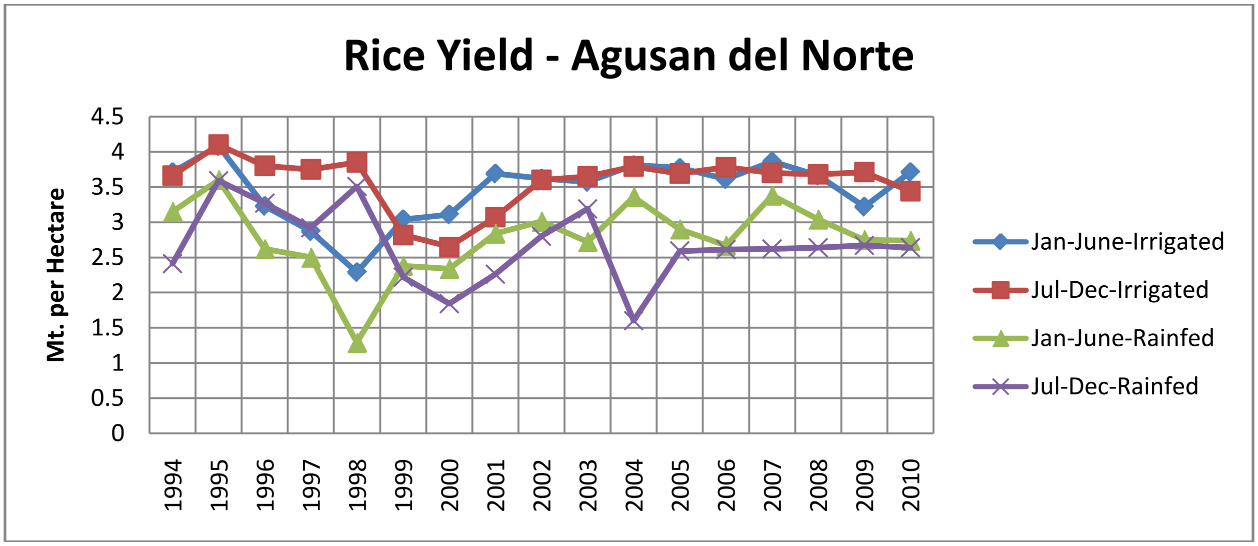
3,600 kls	Expenses:
X .65% recovery	Milling fee = P50x46.8 = P3,276.00
==========	Labor = P5x46.8 = 234.00
2,340 kls	Sacks = P8x47 = 376.00
x P37	Transportation= P15x47 = 705.00
=========	Drying fee P5x72 = 360.00
P86,580 = Gross Income	=======
- 52,951.00	P4,951.00

= **P33,629.00** Net Income
Rice farmers = 726, Area = 1,742 has (Mostly irrigated)

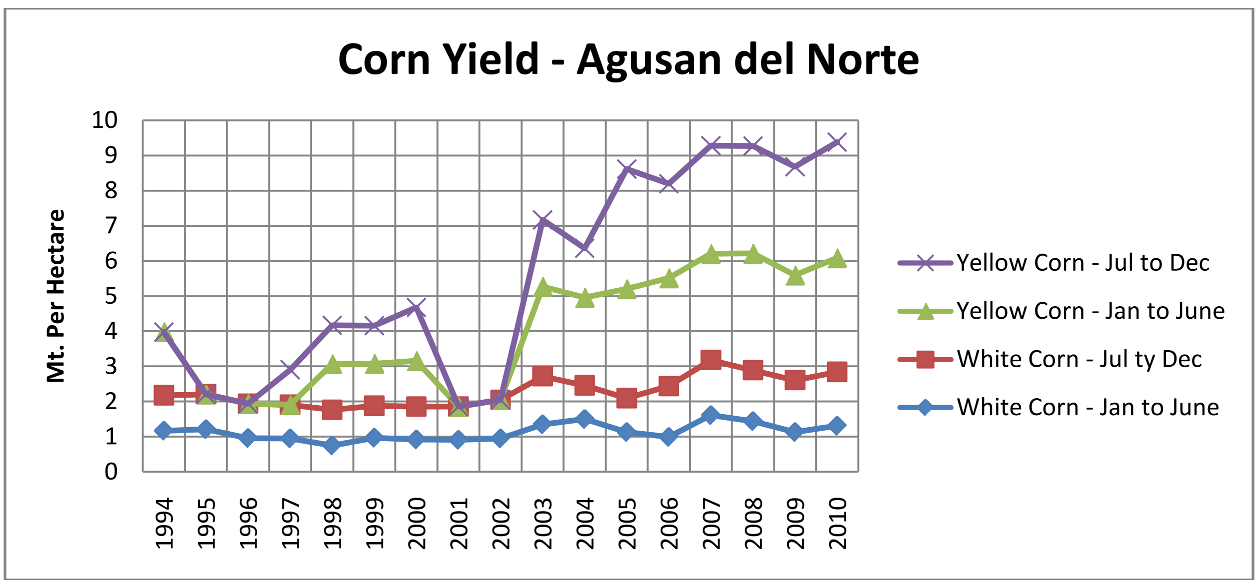
Annexure 4: Partners of ILO under CCAP

- **Department of Labour and Employment (DOLE):** It is a primary government agency mandated to promote employment opportunities, develop human resources, protect workers and promote their welfare. DOLE has experience in rolling out social protection schemes like Social Amelioration Fund (SAF) for sugarcane growing areas in Philippines. A similar scheme is envisaged to be implemented in the project area.
- **Department of Trade and Industries (DTI):** It is another primary government agency with the dual mission of facilitating the creation of a business environment wherein participants could compete, flourish, and succeed. DTI is responsible for implementing financial schemes to provide capital to small enterprises in the project area.
- **Department of Science and Technology (DoST):** It is a primary government agency with dual mandate of providing central direction, leadership and coordination of all scientific and technological activities, and of formulating policies, programs and projects to support national development. One of the deliverables of the project is to capacitate people to tackle with the climatic disasters. This would be achieved through setting up early warning systems across the selected municipal areas with an active help from DoST.
- **Philippines Crop Insurance Corporation (PCIC):** PCIC is the key implementing agency of the agricultural insurance program of the government. Apart from indemnity based crop insurance, PCIC has experience of underwriting insurance packages for livestock, personal accident, life, warehouses, rice mills, irrigation facilities and other farm equipment. It should be noted that PCIC is the sole crop insurance underwriter in Philippines. PCIC is keen to underwrite better crop insurance products like area yield index insurance and weather index insurance.
- **Agusan del Norte Provincial Government:** The provincial government through its municipal level employees is expected to play a major role in actual implementation of the schemes under CCAP.

Annexure 5: Yield for Rice and Corn – Agusan del Norte



Source: Bureau of Agriculture Statistics, Agusan del Norte



Source: Bureau of Agriculture Statistics, Agusan del Norte

Yield for major crops in RTR (MT per hectare)

Commodities	Year							
	2002	2003	2004	2005	2006	2007	2008	2009
Rice 1st copping	4.00	4.08	4.97	4.73	4.62	4.44	4.54	4.14
Rice 2nd copping	4.02	4.29	5.19	5.03	4.95	5.39	5.05	4.87
Abaca	1.25	1.25	1.25	1.25	1.25	1.26	1.27	1.295
Banana	12.03	12.5	11.8	12.2	11.82	10.483	9.908	9.5583

Source: Vulnerability and Adaptation Assessment report, ILO CCAP

Annexure 6: Major floods in Butuan City

No.	Date of Occurrence	Type of Disaster	No. of Affected Barangays	Affected Population		Evacuated Population		Damage Houses			Casualties				Total Cost of Damages		
				Families	Persons	Families	Persons	Totally	Partially	Total	Dead	Injured	Missing	Total	Agriculture (in pesos)	Infra (in pesos)	Total (in pesos)
1	February 1999	Flashflood due to La Nina	2	53,929	271,924	0	0	0	0	0	12	2	0	14	53,130,000.00	P79,540,000.00	P114,670,000.00
2	February 2000	Flashflood		0	0	0	0	0	0	0	0	0	0	0	685,650.00	25,300,000.00	25,985,650.00
3	February 16-19, 2001	Flood due to continuous heavy rains		3,658	17,279	0	0	0	0	0	0	0	0	0	4,355,000.00	8,000,000.00	12,355,000.00
4	Dec. 30, 2001 – January 12, 2002	Flashflood due to continuous heavy rains	51	11,149	52,264	597	2,383	0	7,425	7,425	0	0	0	0	33,820,000.00	29,240,000.00	63,060,000.00
5	October 24, 2003	Flashflood due to Continuous heavy rains	2	523	3,138	0	0	1	19	20	0	0	0	0	P456,885.00	P10,350.00	P467,235.00
6	February 8-15, 2004	Flood due to continuous heavy rains	29	11,668	51,555	292	1,462	0	4	4	0	0	0	0	1,169,645.00	0	1,169,645.00
7	Feb. 7-13, 2006	Flooding due to	55	22,618	115,301	1,153	5,718	0	0	0		0	1	5	17,015,970.00	50,960,000.00	67,975,970.00

		Monsoon rains															
8	January 2-15, 2007	Flooding due to Monsoon rains	22	7,403	31,499	0	0	0	0	0	0	0	0	0	0	0	0
9	January 10-18, 2009	Continuous heavy rains due to the tail-end of a cold front	2	332	1,992	0	0	0	0	0	0	0	0	0	0	0	0
10	November 20 – 25, 2009	Continuous heavy rains for five (5) days	8	285	1,423	158	828	4	10	14	0	0	0	0	0	0	0

Source: OCD, Caraga regional office

Annexure 7: Rice claims data for Agusan del Norte

Rice												
	Flood and typhoon			**Drought**			**Pests**			**Diseases**		
	Farmers	Area (Ha)	Claims (Pesos)	Farmers	Area (Ha)	Claims (Pesos)	Farmers	Area (Ha)	Claims (Pesos)	Farmers	Area (Ha)	Claims (Pesos)
2001	18	40.25	49041.79	9	14.5	53402	198	332	778616	4	7	15691.24
2002	15	38.5	49650	16	24.75	108195.7	391	611.7	1330024	4	7.5	12240.5
2003	52	67.3	123211.7	5	11	38289.50	208	296.25	737524.2	13	172.25	79500.29
2004			2558693			173129.1			870439.3			387466.5
2005			8320			6942.28			1213018			
2006	94	166.25	411715				433	707.25	1725855	2	3	7056
2007	24	43.5	93480				462	761.5	1227415	13	21.25	41670
2008	12	22.25	66929				429	728	1089673	21	30	40017
2009	99	145.75	407596	103	173.9	578124	242	407.96	829550	147	215.79	384175

Source: PCIC, Regional Office, Cagayan de Oro