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MID-TERM EVALUATION OF THE CLIMATE SERVICES SUPPORTING ADAPTATION IN THE INDONESIAN FOOD CROPS SYSTEM



19 February 2014

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PHOTO: A Climate Field School in operation (Setiadipraktiko, 2012)

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GLOSSARY

BMKG	Badan Meteorologi, Klimatologi dan Geofisika [Agency for Meteorology, Climatology and Geophysics]
BNPB	Badan Nasional Penanggulangan Bencana [National Agency for Handling Disasters]
BNPD	Badan Penanggulangan Bencana Daerah [Agency for Handling Regional Disasters]
Bupati	District (kabupaten) chief
CCIS	Climate Change Information Service
CCRD	Climate Change Resilient Development
CFS	Climate Field Schools
ENSO	El Nino Southern Oscillation
FFS	Farmer Field Schools
IPB	Institut Pertanian Bogor [Bogor Agricultural University]
ICT	information and communication technologies
IPM	integrated pest management
IRI	Institute for Climate and Society, Columbia University
Kabupaten	District or Regency, the administrative level of government below the province and the most important sub-national level of government
NMHS	national meteorological and hydrological service
NOAA	U.S. National Oceanographic and Atmospheric Agency
PPL	penyuluh pertanian lahan [agricultural extension officer]
SDEWS	Seasonal Disaster Early Warning System
SOI	Southern Oscillation Index
SST	sea surface temperature
T&V	training and visit agricultural extension methodology

I. CONTEXT

I.1 THE EVALUATION OF CLIMATE SERVICES

Increasingly, countries around the world are developing climate services in order to better inform planning and decision making across many of the sectors and populations affected by accelerating climate change. At the second International Conference on Climate Services, held in Brussels, Belgium in 2012, a series of self-reported case studies were unveiled by various agencies working on climate services. These were judged to be potentially quite valuable as models or sources of lessons to be applied in the design of new climate change adaptation tools and services.

Nevertheless, it is equally important to monitor the performance of these and other climate services and document their evolution over time. The evaluation of climate services is important to ensure that the services provided are meeting their intended goals and how these, in turn, contribute to improved welfare in targeted households, communities, and populations.

For the purpose of this “mid-term” evaluation, climate services are defined as follows:

“Climate services are designed with the goal of providing people and organizations with information they can use to reduce climate-related losses and enhance benefits, including the protection of lives, livelihoods, and property. They convey information about average weather, departures from average conditions, and low-probability events, while estimating trends through the analysis of time series data.”¹

The subjects of this climate service mid-term evaluation are the Indonesian Seasonal Drought Early Warning System (SDEWS) and the Climate Field Schools (CFS), which are one of the users of the information generated by the SDEWS. Both of these services support adaptation to climate change in Indonesia’s food crop systems. Specifically, they are designed to provide information for food crop production in rice and related secondary crops.

I.2 THE PROBLEM BEING ADDRESSED

Indonesia’s most important staple crop is rice and within that category paddy rice whether technically irrigated or rainfed is the dominant rice crop type. Rice is quite susceptible to climate change impacts,

¹ C. Vaughn, CSP Evaluation Guidelines, draft, May 2013, p.1

whether these are changes in temperature or changes in water quantity (drought) or quality (increased salinity).

Changes in temperature regimes greatly influence not only the growth duration, but also the growth pattern and the productivity of rice crops. A decrease of 10 percent in rice yield has been found to be associated with every 1 °C increase in temperature. In the Philippines, it was reported that the yield of dry-season rice crops decreased by as much as 15 percent for each 1 °C increase in the growing season mean temperature.²

In Indonesia, the total damaged area and production losses because of flooding were estimated to be 268,823 ha and 1,344 million tons, respectively. With an average yield of 5.0 tons/ha, economic losses were estimated at about USD 353.7 million/year affecting 4.4 million farm households.³ Nevertheless, drought is the most serious constraint to rice production since most of the farmers' preferred rice varieties are very susceptible to drought stress.⁴

Though salinity affects all stages of the growth and development of the rice plant, when the rice is at the young seedling stage it becomes even more sensitive to salinity.⁵

The final factor in the rice production cycle affected by climate is the selection of the appropriate planting date. The planting date can have a dramatic effect on the development and yield of the crop. As temperature varies, the objective would be to try and select the right date for crop establishment in order to allow for the reproductive and grain filling phases of rice to take place during the months with a lower temperature.⁶

Even in "normal times", agriculture is a high risk venture. However, rice cultivation on Java confronts a number of additional risk factors. The island is very densely populated including the rural areas. With a land area of 49,536 sq. miles Java is only slightly larger than the U.S. state of Mississippi. But Java has a population of 141 million whereas the population of Mississippi is just under 3 million. In addition, Java has numerous volcanoes (45 of them active!) and is tectonically very active with frequent earthquakes some very serious. Because of the island's volcanic origin the spoils on the steep slopes of the mountains is very susceptible landslides, especially during the wet season.

² Suzanne Redfern, et al., 2012, *Rice in Southeast Asia: facing risks and vulnerabilities to respond to climate change*, p. 296

³ Ibid., p. 296

⁴ Ibid., p. 297

⁵ Ibid., p. 298

⁶ Ibid., p. 302

Hence, the inherent risk factors facing Javanese rice cultivation are significantly increased if climate change risks are factored in. The Indonesian Government has recognized this and hence has developed climate information services to try to address these risks.

2. ASSESSMENT APPROACH

The Indonesian SDEWS and CFS are separate but complementary services within a larger Indonesian Government panoply of services aimed at preventing undue damage from natural disasters of which drought is one form. The services are aimed at reducing agricultural production risk from seasonal weather problems and, hence improve food security in the country. The SDEWS is a major component of the agricultural information “supply side” while the CFS is a service that fills part of the demand side (users) of agricultural information.

The evaluation questions which framed the assessment approach are:

What specific needs do the climate services attempt to address?

- How efficient and useful are the products/services produced by the two services?
- Have they helped to increase users’ knowledge and, if so, how?
- How sustainable are the two services?
- How will these two services likely evolve in the future?

The mid-term evaluation was necessarily brief due to field trip time constraints and level of effort. However, the local counterparts were very helpful and informative and enough information and insights were obtained to develop a useful evaluation case study.

2.1 DESKTOP LITERATURE REVIEW

The first step in the assessment procedure was a desktop literature review. This consisted of documents from the BMKG itself as well as the Bogor Agricultural University (IPB) and third party analysts and scholars looking at climate change adaptation in the Indonesian food crop sector.

The literature review provided much useful information, especially on the CFS. This was also true for the interviews. This is primarily because the CFS, represents the user of the climate-related information and is also site and population specific. Even on an island the size of Java there is a very large variation in agro-ecosystems as well as wider local economy. This introduces a dynamic of institutional variability that makes modeling the impact of these schools a bit difficult as this report makes clear below.

2.2 SEMI-STRUCTURED INTERVIEWS OF IPB STAFF, GOVERNMENT PARTNERS AND FARMERS

Upon arrival in Indonesia, the evaluator contacted the IPB Climate Team to set up semi-structured interviews with team members as well as local government counterparts in two districts (*kecamatan*) where pilots of both the SDEWS and CFS were underway and the farmers that are ultimate end users of the climate service.

The purpose of the semi-structured interviews of local government was:

1. To determine how well relevant local government staff understood the two climate services and
2. To what extent they found them useful and relevant to their governmental mandate.

The purpose of the semi-structured interviews of farmers was:

1. To gauge their understanding of the information provided through the CFS
2. To identify the strengths and weaknesses of the CFS from their (the user) perspective.

3. CLIMATE SERVICES EVALUATED

3.1 INDONESIAN GOVERNMENT PARTNERS

3.1.1 BMKG

Indonesia's climate services are based around the data gathering and analysis undertaken by the Agency for Meteorology, Climatology and Geophysics (BMKG). The BMKG is a governmental agency with the mandate to disseminate weather, climate – including air quality – and earthquake information. BMKG collects data on weather, climate and earthquakes from more than 200 observation stations nationwide to provide data on these events and now also tsunami information services to Indonesian government departments, businesses and citizens. BMKG is part of the Ministry of Research and Technology.

3.1.2 BPBD

Indonesia is highly prone to natural disasters straddling, as it does, the meeting of the Eurasian and Australian tectonic plates. This very active fault zone gives rise to numerous earthquakes, volcanic eruptions and tsunamis. In addition, Indonesia suffers from seasonal flooding and droughts, which have become more extreme over time due to the impact of climate change. Because of this inherent high risk of natural disasters, the government created a special agency to address these. The Indonesian National Disaster Management Agency, known by its Bahasa Indonesia acronym BNPB, was formed in January 2008 by presidential decree. It manages 399 provincial and municipality-level bureaus. The sub-national offices are known as BPBD (Regional Disaster Management Agency). The large majority of BPBD offices are poorly resourced but some

have better trained and resourced staff. It is the BPBD that manage the local coordination of the SDEWS data and forecasts and that work with the extension officers to get the information to farmers.

3.1.3 DEPARTMENT OF AGRICULTURE

The third leg of the Indonesian climate services for agriculture adaptation is, of course, the Department of Agriculture. The main relevant body for coordinating the use of climate information for agricultural planning is the National Center for Agricultural Extension Development. However, at an operational level, principal coordination is with staff of the BPBD and district agricultural extension officers (commonly called PPLs). It should be noted further that with Indonesia's dramatic decentralization law (Law no. 22/1999) much of the traditionally strong management of agriculture was transferred to the *kabupaten* (district) level of government. This has weakened the agricultural extension system but also opened up new opportunities for private and NGO forms of agricultural extension. The most important government official for directing agricultural development and extension is thus the head of the district (*Bupati* or District Chief).

3.2 THE IPB CLIMATE TEAM

The Bogor Agricultural University's (IPB) Center for Climate Risk and Opportunity Management (CCROM) also known as the "Climate Team" was the host for this mid-term evaluation. IPB is Indonesia's center of excellence in agriculture and the CCROM, drawn from a number of the faculty of the University to form a multidisciplinary team has been a leader in carrying out climate change related research and developing climate adaptation services for agriculture in Indonesia. The Team is headed by Prof. Rizaldi Boer.

3.3 CLIMATE SERVICE PRODUCTS

Given its large area and location in the tropics, drought is not an uncommon phenomenon in various places in Indonesia at any given time and influences many sectors such as agriculture, electric power, transport, drinking and process water supplies, etc. BMKG has carried out drought prediction research in Indonesia using satellite rainfall data as part of an international research collaboration. That study recommended developing a methodology for a Drought Early Warning System (DEWS) as part of the daily operations within BMKG and a part of its Climatological Early Warning System.

Like other national meteorological and hydrological services (NMHS), BMKG issues rainfall predictions based on the observed data throughout the country. The data are transformed into a percentage-to-normal index and plotted throughout every region in Indonesia. A Standardized Precipitation Index (SPI) is also provided using Seasonal Climate Outlooks for Pacific Island Countries (SCOPIC) software from Australia. The seasonal outlook is used as a tool for defining and monitoring drought. In addition, BMKG also disseminates soil water content (SWC) information based on evapotranspiration rates measured nationwide.

For practical purposes, BMKG has established drought early warning forecasts on the basis of monitoring consecutive dry days or consecutive no-rain days. The information presented this way seems to be of more practical use from the perspective of end-users, such as farmers because it directly translates the meteorological data into levels of drought. The dry spell information is updated every ten days. Although, it is still difficult for farmers to apply it directly for purposes such as timing planting, cultivating, or plowing activities, the facilitation through the CFS may make it easier for farmers to understand their relative vulnerability in a given growing season.⁷

One of the most important services of BMKG is the creation of synoptic maps and data tables. A synoptic chart is the scientific term for a weather map. Synoptic charts provide information on the distribution, movement and patterns of air pressure, rainfall, wind and temperature. This information is conveyed using symbols, which are explained in a legend. Synoptic charts are used to report on the current weather and to predict future weather patterns. The BMKG has developed a web-based, database management system that is based on near-real time data analysis (see the following discussion). These maps and tables and the underlying datasets are disseminated to users including research institutes, local government agencies and relevant national government agencies. In addition to current weather data, BMKG has implemented DiDaH, which is the digitization of historical data some of it going back to the late 18th century in order to enrich long term climate trends.

3.3.1 SEASONAL DROUGHT EARLY WARNING SYSTEM (SDEWS)

3.3.1.1 DESCRIPTION OF THE SERVICE

To address the need for a local and regional government user-centric drought information system, BMKG and the German foreign assistance agency GIZ developed the Climate Change Information System (CCIS) as the central web-based climate information dissemination platform. The CCIS is oriented towards public administration, especially district government staff as the primary users. The dissemination of climate information for cross sectoral drought management follows a number of criteria. The most relevant is the need to bridge the gap between scientifically useful climate information and technically usable climate information. Different users have different needs and skill levels which need to be addressed appropriately. Furthermore legal and institutional constraints have to be considered for data and information dissemination. For example, the technical information portal alone cannot fully comply with local government's information needs' for agricultural forecasting and planning. There needs to be a dialogue between the information provider and the user to create useful and practical information. To this end, BMKG initiated the use of

⁷ Andi E Sakya, 2013, BMKG's Potential Drought Monitoring Information, p. 10-11

Focal Group Discussions (FGD) with sector representatives to facilitate user understanding and use of the climate information.

The portal also contains a comment function which can supplement those discussions. The web portal has extensive user and information product management options. The operator is able to finely adjust the information access rights. This serves two purposes: a) BMKG as the information provider is able to control which user has access to which information and b) The users are not flooded with undesired information. The user can choose the information he needs and define pre-sets (which requires prior agreement) in his personal dashboard e.g. the sectoral (agriculture, industry, etc.) or spatial (e. g. province) sub sets. Climate information for the purposes of drought forecasting, planning and management can be featured with interpretation to assist the user in evaluating the information in their individual sectoral context. These features are intended to narrow the usability gap between the science based information provider, i.e. BMKG and the sectoral users. With regards to drought management, a plethora of actors and sectors are faced with the challenges of planning, managing and tracking droughts. Contexts and needs can diverge, so the CCIS gives users a great deal of control and provides climate data interpretive algorithms to aid the user in applying the data to a particular sector's needs. This is where cooperation and coordination with the Department of Agriculture becomes very important.

The CCIS system produces several regular products that are essential to assist local governments in assisting farmers with their crop calendars and crop selections. This is especially the case for the island of Java but also in other islands to a more variable extent. These products include the following:

- Return period map of maximum rainfall
- Climatology of rainfall, temperature, wind
- Climatology of rainy and dry season onset
- Maps of shifts of rainy and dry season onset
- Vulnerability map to drought for rice producing provinces
- Climate Field School for farmers in crop producing provinces⁸

Exhibit 1 provides an example of the parameters covered in one of these regular reports; the all-important rainfall forecasts. These reports are used in discussions, usually headed by the district chief (*Bupati*) to provide recommendations on what to plant and when as well as any additional requirements for infrastructure or commodities such as seeds and fertilizers. The climate information and additional requirements are then transferred down the chain of command to farmer organizations in the district.

⁸ Ardhasena Sopaheluwakan, 2011, Overview of Climate Services in Indonesia

Exhibit 1 Medium and Long Range Forecast Parameters used at BMKG - Indonesia

MONTHLY FORECAST	Total rainfall forecast
	<ul style="list-style-type: none"> • Total rainfall respective to normal
	<ul style="list-style-type: none"> • Monthly forecast is issued and updated early every month for at least 3 months ahead
SEASONAL FORECAST	<ul style="list-style-type: none"> • The onset of Dry/Wet Season.
	<ul style="list-style-type: none"> • Total rainfall and relationship to normal of total rainfall during the Wet Season
	<ul style="list-style-type: none"> • The Dry Season forecast is released early in March and Wet Season forecast early in September.

Erwin Makhmur, Drought assessment over Indonesia related to El Nino and SSTA Indonesia, 2009, p. 16

In the context of BMKG's CCIS, the IPB Climate Team have focused on a subset of the annual rice production cycle, specifically the risk factors for a second rice crop. Here drought becomes a decisive factor in decision making. Drought is a major factor causing crop failures in Indonesia. In Indonesia, periodic widespread drought events are strongly associated with the global phenomenon of the El Nino Southern Oscillation (ENSO). A secondary factor is changes in sea surface temperature (SST). This is because El Nino strongly impacts rainfall variability. When an El Nino year occurs (every 3-5 years), dry season rainfall will decrease significantly and the availability of irrigation water from reservoirs becomes very limited; often not enough to irrigate all rice fields within the command area. This often leads to crop failure. In addition during an El Nino year, the wet season onset is often delayed, by as much as 3 months. In rice agro-ecosystems, delay in onset will delay the start of the first planting (i.e. the wet season planting) and this consequently also delays the second planting (i.e. the dry season planting) and so the drought risk of the second crops will increase.⁹

IPB's Climate Team research has led to the development of a seasonal drought early warning system (SDEWS) that can inform up to six months in advance the level of drought risk that may occur in second planting season as well as the potential area that will be affected by the drought. With a six month lead time, the level of risk of the second crop (May-June year) can be more accurately estimated before the first crop in wet season is planted (August or September). As with the overall CCIS, the SDREWS is web-based and can be used by user interactively. The result of a number of validation tests showed that the level of accuracy of

⁹ Rizaldi Boer, IMHere, p. xii

the system may reach 85% if the drought risk forecast is given two months before the second crop is planted (i.e. March).

However, the SDEWS is not limited to the provision of climate information to local government planners and decision makers. The IPB Team, working with local governments has also been engaged in a dialogue to explore adaptation options, i.e. in the likely event of a drought what kinds of options are available to farmers. Farmers won't necessarily be able to switch to a drought-tolerant crop if the seeds and other associated inputs (fertilizers, equipment, credit, etc.) are not available. Finally, the Climate Team is developing a practical climate adaptation online learning module to give to Indonesian agricultural extension officers. As will see below, the Climate Team is also helping extension workers nationally to make effective use of the CFS.

Local government capacity to implement the CCIS (or the SDEWS) is still relatively limited, a function of insufficient training in the use of the climate database as well as techniques for running interpretations of the data for adjusting the cropping calendar or planning other adaptation measures. The problem may also be associated with the availability of equipment and connectivity. But, the Government has prioritized the development of information and communication technologies (ICT). The Climate Team decided to test the SDEWS and the associated CFS in two sites on Java and one in East Kalimantan Province. The two Javan sites are Pacitan Kabupaten in East Java Province and Indramayu Kabupaten in West Java Province.

In Indramayu District, the institution that was set up to manage climate risk is called Forum on Climate Information Utilization. The forum is a medium for communication and dialogue between reagents and farmers/communities. The forum is supported by the Climate Advisory Team and a Technical Team for Managing Climate Risk. The technical team is hosted by district-level Agency for Food Security and Extension Services (BKP3). The technical team is responsible for making the SDEWS operational and for developing recommendations for taking anticipatory options based on the outputs of the SDEWS. In Pacitan, only the technical teams have been developed. The Coordination Forum will develop anticipatory action plans and passed them to sub-district through the Farmer Groups Association (GAPOKTAN) and then to villages through individual farmer groups.

SDEWS provides risk information in the form of drought probability forecast and the potential area to be affected by drought for the second planting crops. The system tries to provide this information six months in advance using real time data of Southern Oscillation Index (SOI). The forecast can be periodically updated up to March of the planting year, i.e. typically two months before the second crop is planted (May-August). If the

drought probability forecast exceeds a critical value or a threshold, anticipatory actions have to be carried out. This threshold value is typically defined by the Forums.

The process of implementing the SDEWS at the District level is described in Figure 1 below. Although the SDEWS description emphasizes the role of dialogue with farmers in the decision making process, in fact, the system, as described below is typically a top-down one. In dialogues with members of the technical teams in both Pacitan and Indramayu, however, planning and decision making is not as formal as described. Technical Team members, especially the extension officers, frequently interact with farmer groups and even with individual farmers, especially so-called progressive farmers (those willing to take risks with agricultural innovations). Understandably, a real dialogue over interpretation of the climate data would be difficult with large groups of farmers who are not technically trained. However, during the field visit to Indramayu, conversations with the farmers brought up the existence of traditional indicators of upcoming drought. These include the appearance of specific plants or insects. It would be potentially useful to carry out an ethnographic study of traditional indicators and other signs of weather change that might enrich drought predictions based on scientifically observed and interpreted data.

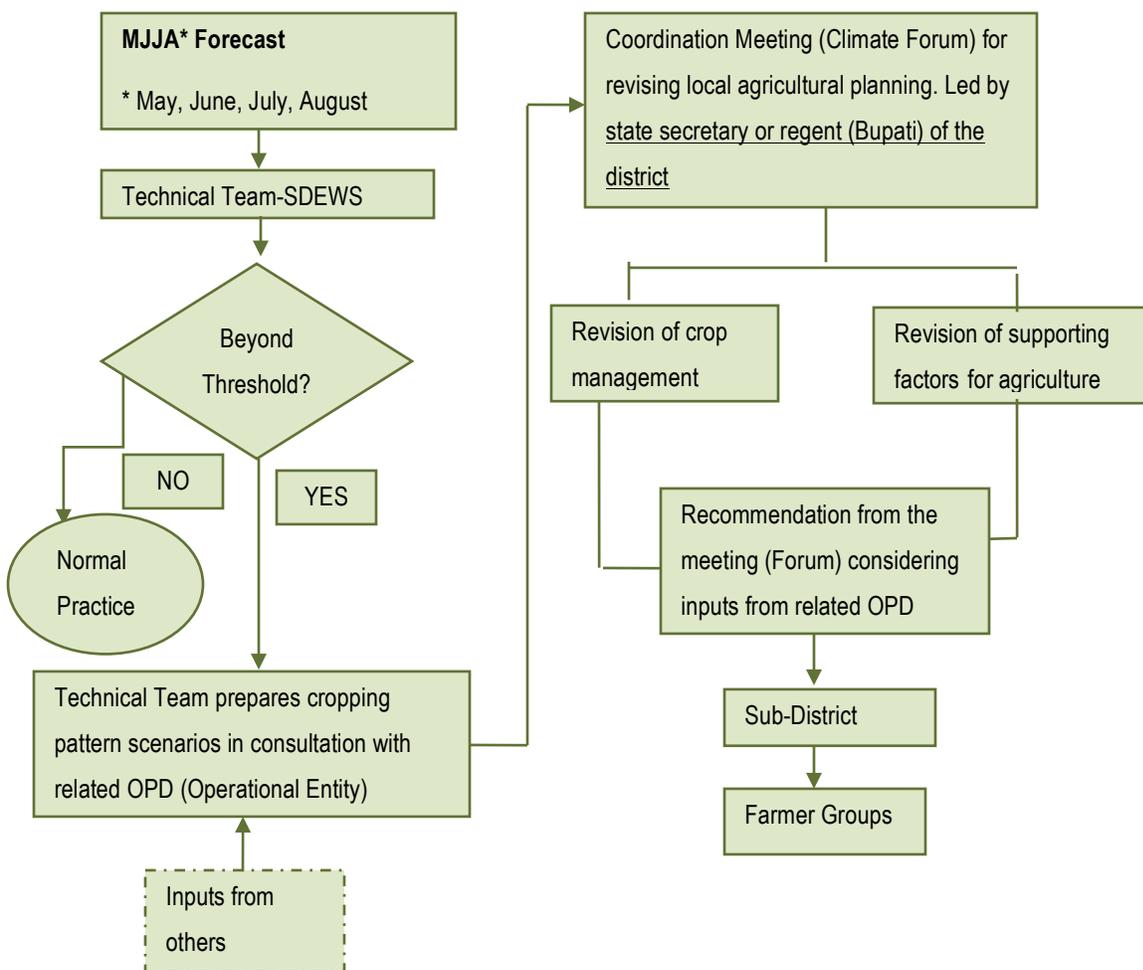
3.3.1.2 STRENGTHS

The SDEWS, like the overall CCIS in Indonesia, is based on the use of scientific data and, more specifically, widely accepted indicators of climate change's impacts on food crop systems, in particular paddy rice. In addition, the system is web-based and accessible to the public, though access to it does require permission. One of the problems of developing predictions of climate change impacts on regions and localities is the inadequate downscaling of large general circulation models and other climate models. Countries like Indonesia are gradually assembling large hydromet databases that will eventually greatly improve the specificity and reliability of agricultural forecasts while enabling these to be made earlier and earlier.

3.3.1.3 WEAKNESSES

In the timeframe of the evaluation, no significant structural weaknesses were noted. However, two weaknesses in the development of the SDEWS were noted. One of them, which was discussed with the Climate Team, was the failure of the Team to “journal” the process of the development and rollout of the SDEWS and the CFS. This is not to say that neither mechanism hasn't been documented. Indeed both have, as reflected in the references to this report. However, the process described in most of the documents is aspirational not a recording of what actually happened while both mechanisms were being developed. The journaling of the process of development and especially the implementation of the SDEWS and the CFS in the two pilot districts would be very valuable for fine tuning the model for dissemination to Indonesia's 488 other districts.

Figure 1. Operation of the SDEWS and Its Institutional Arrangements at the District Level



From: Adapted from Rizaldi Boer, 2011, *Development of Dynamic Crop Calendar for Managing Drought Risk in Rice-Based Farming System*, Slide 15.

3.3.2 CLIMATE FIELD SCHOOLS

3.3.2.1 THE FARMER FIELD SCHOOL METHODOLOGY

The Climate Field Schools program is a direct descendant of the Farmers Field Schools, which the FAO Inter-Country Program developed in the 1980s. At the time, the Green revolution gains in rice productivity were being jeopardized by the overuse of subsidized pesticides leading to pest resistance and then declining yields per hectare. The problem was especially acute in Indonesia. The solution was to a) phase out pesticide subsidies and b) introduce integrated pest management (IPM). IPM requires knowledge of the rice agro-ecosystem and how natural predators keep pests in check as well as the minimal amount of pesticide use and other elements of crop management.

Crucially, the FFS methodology required:

- farmers organized voluntarily into groups
- an ethos of learning the principles of IPM and adapting and applying them in the field by the farmers themselves
- FFS educational methods are experiential, participatory, and learner centered
- The school is in or near the rice fields themselves
- Each FFS compares IPM and non-IPM plots in order to directly note the differences in yields and management
- FFS requires carefully trained and experienced facilitators. Increasingly, many of these have come from FFS farmer graduates though most are still extension workers.

From a narrow cost-benefit analysis viewpoint, the FFS approach is more expensive than the traditional training and visit (T&V) system but it also has been more sustainable and effective since it has relied on the active involvement of farmers in learning and adapting rather than being passively trained in what was often a one-size-fits-all approach. In Indonesia, the FFS methodology has proven to be very popular among rice farmers themselves.

3.3.2.2 DESCRIPTION OF THE SERVICE

The Climate Field Schools are still very much in the pilot phase of development. The CFS is a three-step process. First, the district level agriculture officers are trained to understand climate concepts, interpret climate forecasts, and ways of integrating them in agricultural activities. Second, the district level agriculture officers train sub-district level extension workers. Finally, the sub-district extension workers conduct dialogues with farmers for 20 meetings over two cropping seasons. These dialogues involve reinforcing the perception of farmers on climate patterns (e.g. varying dates of the onset of rainy season, increased probability of flooding in certain months) through the use of climate data.

There are currently three CFS sites in which the IPB Climate Team participates: in Indramayu Kabupaten, West Java, Pacitan Kabupaten, East Java and a new site in East Kalimantan province (see location of Java sites in Figure 2 below). However, after the experience of the first CFS in Indramayu, the number of CFS's has increased. In 2007, the Indonesian Ministry of Agriculture organized 145 units of CFS in 19 provinces and planned to organize 100 units more in 2008.

From 2006 until 2010, the CFS has been conducted in at least 500 villages across 30 provinces in Indonesia. By explicitly drawing on the FFS inspiration, the CFS model was a signal that the aim was to take a deeply farmer-driven approach to climate adaptation. However, no one from the original FFS movement has been

involved in the design of the CFS, an absence that likely has influenced the ways in which the CFS has been implemented.¹⁰

From an agro-ecological viewpoint, the two sites provide an interesting contrast. In both sites, the primary emphasis is on critical staple crop systems, especially paddy rice.

The two pilot locations on Java, which produces nearly half of Indonesia's rice. Indramayu is on the north-central coast. It is mostly irrigated, mainly lowland and is a densely populated region. Pacitan Kabupaten is in East Java Province on the south-central coast of Java. It is very hilly, dominated by karst formations, narrow river valleys but is also a densely populated region), It has a number of well-known surfing beaches and so a minor tourism industry as well.

The CFS was explicitly intended to be a mechanism for institutionalizing the communication and application of ENSO-based seasonal climate forecasts. The objectives of the CFS were to increase farmers' knowledge about climatological processes, to increase farmers' ability to anticipate extreme events in their agricultural planning, to improve farmers' capacities to observe climate variables, and to facilitate farmers' use of formal climate information in conjunction with their own experiences and knowledge in their management decisions.¹¹ After following the program, farmers were expected to apply the climate information in setting up alternative crop management strategies¹².

Improving the capacity of farmers groups to manage climate risks has been the rationale for strengthening the capacity of extension services institutions, which themselves had gone into a serious decline since the disruptive decentralization process that began in 1999 and that transferred control over sector budgets to the districts. Climate Field School modules for extension workers on climate risk management have been developed. The modules can assist extension workers in facilitating farmers during the implementation of climate field schools. The IPB Climate Team has observed that the presence of trained extension workers during climate field schools is important. A national extension service forum has been organized that can accelerate the exchange and sharing of knowledge and information on climate risk management across villages and regions. The Directorate of Plant Protection of the Ministry of Agriculture has endorsed the proposed forum. Subsequently, the forum was established in 2012 by ministerial decree. The expectation is

¹⁰ Siregar and Crane, 2011, Climate Information and Agricultural Practice in Adaptation to Climate Variability: The Case of Climate Field Schools in Indramayu, Indonesia

¹¹ See Boer et al., 2006, **Institutionalizing Climate Information Applications: Indonesian Case**

¹² Ibid.

that the forum can play significant role in increasing the number of CFS's thus increasing the capacity of farmers to manage their climate risks. Lesson learned from the use of SDEWS and their CFS from Indramayu and Pacitan can be disseminated to other district via this national forum.¹³

Figure2: Location of Indramayu and Pacitan kabupaten on the Island of Java.



Since the initial CFS in Indramayu, additional CFS were organized in other sub-districts in Indramayu and then in Gunung Kidul in Yogyakarta Special Region, a historically very poor region that has been successfully reforested over the past 30 years. Gunung Kidul is also adjacent to Pacitan District.

3.3.2.3 STRENGTHS

The biggest strength of the climate field schools is their direct involvement and communication with farmers. By providing training in the key concepts around climate change and uncertainty, the farmer is less helpless in the face of the impacts from climate change and, to a degree, can be empowered by that knowledge. In the interviews with the farmers in Indramayu, it was clear that ordinary farmers had a grasp of the basic concepts around climate change. What they wanted, however, was to be more involved in experiments to develop alternative responses to those impacts including new cropping strategies, cultivation techniques, tools, seeds and other inputs. Such experiments do seem to be

¹³ Boer et al, Final Report of the IMHere Project, p. xiv

occurring in other places such as Gunung Kidul and Pacitan (see next section) but more of these need to be done and to be well-documented..

3.3.2.4 WEAKNESSES

Overall, the approach taken in the CFS strongly emphasized the farmers' abilities to interpret the data, analytical approaches, and practical recommendations promoted by governmental and scientific institutions. Although understanding climatological forecasts could theoretically be useful for farmers, the lower priority apparently given to activities that identify, enhance, and build on farmers' knowledge, capacities, and institutional processes represents a substantial break from the original premise of Farmer Field Schools in favor of traditional top-down models of extension and information delivery.

In addition, the problems posed by increasing climate change are less tractable at the individual farm household level than at the landscape level. This is especially the case for irrigated rice cultivation where the timing of planting and water management have to be handled at a much larger level than the individual farmer's plot. In addition, climate change increasingly will require landscape level spatial and land use planning to account for impacts on infrastructure, the location of settlements and other factors.

4. MID-TERM EVALUATION CASE STUDIES

4.1 CLIMATE RISKS: INDRAMAYU AND PACITAN DISTRICTS

Indonesia as a whole has high exposure and variable sensitivity to the El Niño Southern Oscillation (ENSO). Indramayu is very sensitive to ENSO and its impact on reduced rainfall and drought. Pacitan appears to be more sensitive to sea surface temperature (SST) differences but is also affected by ENSO.

On Java, an El Niño year usually entails a delayed onset to the rainy season (from e.g. October to December) and/or highly variable rainfall (little or no rains alternating with sudden large rainstorms and then an abrupt cessation of the monsoon).

La Niña usually entails an early onset to the rainy season and rains extending into the early part of normal dry season. Usually this is positive for crops but excessive cloudiness can be a problem for rice.

According to surveys and interviews this Evaluator did with farmers, the frequency of drought years has increased in the last decade. While some of this may be recall bias BMKG reports seem to substantiate most

of this. In addition, warmer average night time temperatures may have an adverse effect on rice yields since the plant needs relatively cool nights to thrive.

Sensitivity for some populations to the variability and heightened agricultural risk that climate change is bringing is increasing also because of the underlying socio-economic conditions: much of rural Java consists of tiny, fragmented landholdings, which leave little margin for error in the event of mistiming in the cropping calendar. In the context of this uncertainty and the belief that agriculture is fast becoming less viable as the sole source of household subsistence and income, young people are increasingly leaving agriculture. Some part of this flight to the cities or to other occupations may be due to increasing drought frequency but it is equally likely that climate change is exacerbating a long-standing movement of excess populations on Java to the city. Climate change, especially flooding in both case study districts is putting additional pressure on existing infrastructure most of which has not been “climate-proofed”. This is especially true for lowland populations.

4.2 INDRAMAYU CASE STUDY

The Indramayu CFS was the first one established and dates from 2003. While forecasts are still being generated and used by farmer groups, it was not clear from interviews whether or to what degree adaptation planning and associated measures were being undertaken. At least one farmer group interviewed expressed disappointment at the lack of attention to their interests.

Figure 3: Location of Indramayu Kabupaten, West Java Province



4.2.1 AGRO-ECOLOGICAL CHARACTERISTICS: INDRAMAYU DISTRICT

Indramayu District is one of the main rice producing areas in Indonesia, and agriculture comprises 43 percent of the district's GDP. About 65 percent of agricultural land theoretically relies on irrigation while 17 percent is fully rainfed. Indramayu District is located at the bottom end of an irrigation system and near the mouth of the Cimanuk River (see Figure 3).

Most of the topography in Indramayu consists of flat land or with an average gradient of only 0–2 percent, and all of the area lies between 0–100 meters above sea level. This essentially flat topography influences water drainage, meaning some areas suffer from flood during high rainfall events and especially so when such events coincide with high tides. Soil salinity is a real problem in the northern half of the district, especially during the dry season and in ENSO years due to excessive salt water intrusion. Irrigation water is generally abundant during the first planting season (January to March, the peak of the rainy season) and can reach most points of the irrigation district. However, competition with upstream users for irrigation water is high during the second and third planting seasons (April to September, the dry season). This upstream competition is also common in other districts on Java Island. During the dry season, the water often runs short in Indramayu and barely reaches fields at the bottom end of the irrigation command area because farmers in the upstream parts use most of the water. Generally, irrigation districts supply water for either three rice harvests/year or two rice harvests and one “palawija” (secondary crops) on the best crop lands.

In an interview with the District Chief, it became clear that additional problems relate to infrastructure. The number and maintenance of check dams in the interior uplands is very inadequate (they are mostly in an adjoining district) and this leads to large, fast moving floods that damage homes and agricultural fields in Indramayu. Finally drainage ditches and tertiary irrigation canals often suffer from inadequate maintenance leading to silting up and reducing the amount of water brought in or drained out. These in turn lead to water logging or salt water intrusion both of which lower yields.

As a consequence of upstream competition, Indramayu's farmers at the bottom end of the irrigation system have to deal with water deficit for cultivating rice twice a year, even in non-drought years. This is exacerbated by the fact that average household land ownership, especially paddy land is tiny <0.5 ha., often in scattered tiny plots that significantly increase the risk of crop failure or inadequate subsistence.

Population of Indramayu consists mostly of rural households living in small to medium sized villages. Off-farm and non-farm employment is steadily increasing in importance due to the perceived high risk in

subsistence agriculture so that availability of agricultural labor is now becoming a significant problem as a number of the farmers interviewed noted.

I.1.1. 4.2.2 OPERATION OF SDEWS AND THE CFS IN INDRAMAYU.

The original system to address seasonal food crop prediction needs was based on reports from BMKG three months before the normal rainy season onset. Instructions for the start of rice planting or alternative crops went out from District Chief's Office to Agricultural Extension and Food Security teams to village chiefs and farmer groups. The perception of critics was that this was too top-down and needed more feedback mechanisms so Climate Field School model was developed as an experiment. Farmers in this district were already familiar with the FFS model.

Data for the forecasts comes from the BMKG itself supplemented by data from the U.S. National Oceanographic and Atmospheric Agency (NOAA) and the Australian Government. The forecasts assembled at the District Office are then sent out to 31 sub-districts and from there through extension officers (PPL) to farmer groups. Given the decline in the agricultural extension service since decentralization, the Bupati has sought to recruit retired, senior PPLs to organize the CFS's and to train trainers. Currently, there is one PPL for every 2 – 3 villages, which puts a strain on the schedule of PPLs.

According to an analysis of the first CFS in Indramayu in 2003,¹⁴ the aim of the CFS was to make farmers more scientifically literate with respect to climatology and understanding the implications of climate change for their agricultural options. A learning module was created with 12 topics. The topics on the program were categorized into four themes. The introductory theme was basic knowledge of climate science and commonly used terms. It was given in the first four sessions. The second theme was building farmers' conceptual understanding of probabilistic forecasts so that they would understand that not all forecasts were likely to be 100% accurate. The third theme was encouraging farmers to apply the seasonal forecast information in setting up crop management strategies and cropping calendars. Finally, the fourth theme was training farmers on how to make and record rainfall observations using simple homemade instruments.

The current district chief strongly supports this model. The technical team and extension teams at the district office appear to work well together under the leadership of the district chief. The latter coordinates the technical team's work with a Climate Forum of public and private stakeholders that "socializes" the program with communities.

¹⁴ Siregar and Crane, p. 60

Overall, the approach taken in the CFS strongly emphasized the farmers' abilities to interpret the data, analytical approaches, and practical recommendations promoted by governmental and scientific institutions. Although understanding climatological forecasts can theoretically be useful for farmers, the absence of activities that identify, enhance, and build on farmers' knowledge, capacities, and institutional processes represents a substantial break from the original premise of the Farmer Field Schools in favor of more traditional top-down models of extension and information delivery.¹⁵ The Indramayu district chief cited a number of outstanding issues with the CFS. First, the agenda and materials all came from the national government and so do not incorporate enough local information and conditions into the subject matter. Second, many of the PPLs carrying out the CFS are from college faculties of agriculture and don't have a lot of experience or interest in farming. Third, there is a great need for designing and carrying out joint research with farmers. Not only would this be more in spirit with the original FFS but would also yield a great deal of useful information about adaptive capacity and reducing climate change impact sensitivity.¹⁶

Other problems include a lack of sufficient funding to provide support to climate field schools beyond a limited number. The district chief noted that the original funding for the CFS came from the District's own funds and that this was still the case, which greatly limited the number of CFS's. As noted above, priority has been given to areas of Indramayu plagued by recurring floods and drought. The farmer groups interviewed for this mid-term evaluation expressed enthusiasm for the concept of the CFS but were disappointed by a lack of follow through. In addition to the problems cited above the Bupati also mentioned inadequate meteorological equipment to capture and record the variation in rainfall across the district and the need for value-added processing investment, especially to retain more value from horticultural crops that are grown in the second or third dry seasons.

From a vulnerability standpoint, farmers in this region have a variable but generally strong exposure to climate change impacts and because of the local agro-ecology and socio-economic factors are highly sensitive to climate change impacts. Finally, the infrastructure problems inside and outside the district indicate an inadequate adaptation capacity. The climate forecasts may improve this adaptation capacity only somewhat; there is little individual capacity to adapt agriculturally in an irrigated rice cultivation system where synchronicity among farmers in planting and water management is essential. The Indramayu district chief also cited the need for crop insurance as a hedge against the increasing uncertainty in rainfall and the positive role of climate forecasts in setting, more reliable the degree of insurance risk. However, he felt that such

¹⁵ Siregar and Crane, p. 61.

¹⁶ Tarrant, interview notes with the Indramayu Bupati and Technical Team staff. This represents the Bupati's personal opinions.

insurance could only be provided by government or at least with a government guarantee to the insurer since it appeared to him that private insurance companies were not interested in crop insurance.

4.3. PACITAN CASE STUDY

Pacitan is one of the SDEWS operations started after the Indramayu pioneering model and is also supported by the IPB Climate Team. The operation is part of and co-located with the BPBD and agricultural extension offices. The operation appears to be fully equipped with computers for accessing the CCIS and other climate information.

In interviews with the staff, it is clear that the Technical Team is grappling with how best to make the information from the CCIS relevant to the various farming groups in the District. It was unclear whether all villages are being covered or, like Indramayu, if they are focused mainly on the more vulnerable villages and cropping systems.

Figure 4: Location of Pacitan Kabupaten East Java Province



4.3.1 AGRO-ECOLOGICAL CHARACTERISTICS: PACITAN DISTRICT

Traditionally, this has been a very poor part of Java due to its geology and climate. The district is very hilly (52% of the land area) with narrow valleys where irrigated rice cultivation occurs (40% of land area). The district, in fact, is located in a larger region called the Thousand Mountains named for the numerous, same-sized conical hills throughout this region. This is reflective of the prevalence of limestone karst formations in the district's geology; a formation that typically does not retain water.

The use of terracing on steep hillsides is common. Mixed tree crop and row crop systems as well as home gardens provide diversified subsistence and cash crops. Hill side cultivation is mainly tree crops (e.g. coconut, coffee, clove and cacao as well as teak and mahogany) and “secondary” crops (soybean, maize but also cotton and tobacco) usually on terraces. Most of the rice cultivation is either rainfed rice cultivation (the dominant mode) or simple irrigation systems. Technical irrigation systems cover only a relatively small area. Average household land ownership is small and paddy land is especially tiny ~ 0.1 ha. Non-paddy land, including tree crops and cash crops has been growing in importance, e.g. commercial tobacco is a rising dryland crop.

Pacitan’s population consists mostly of rural households living in small to medium sized villages. Off-farm and non-farm employment is increasing in importance but does not appear to be as high as Indramayu (probably because Indramayu is relatively close to major urban centers such as Jakarta, Bandung and Semarang) whereas Pacitan is close only to Yogyakarta. About 65% of the workforce is in agriculture, which is similar to Indramayu. Pacitan is also the home district of the current Indonesian President Yudhoyono.

4.3.2 OPERATION OF SDEWS AND CFS IN PACITAN.

Pacitan is a relatively newer site for testing of the SDEWS/CFS methodology. As with Indramayu, Bogor Agricultural University’s Climate Team helped to develop and continues to support the Pacitan Technical Team that uses the downscaled climate prediction data to determine 1st and 2nd rainy season cropping forecasts and associated calendars as well as the likely onset of the dry season. Unlike Indramayu, there is not yet a Climate Forum group of stakeholders from the public and private sectors with which District Agricultural Office can interact.

Pacitan also has strong support from the District Chief and also appears to have greater funding devoted towards supporting the operations though it wasn’t clear from interviews if there are funding contributions from the national government budget. The climate extension team, part of the agricultural extension team are a part of the disaster prevention and management unit (BPBD). The office has a lot of computer equipment and GIS facilities. Local scientists have been trained in “climate risk management” including the use of climate information for agricultural forecasts and planning purposes through the APN CAPaBLE Project.¹⁷

¹⁷ Boer, et al., 2009

Farmers in Pacitan are increasingly using crop insurance, which is provided by private insurance companies but fully backed by the government mainly for dryland crops like rainfed rice or soybeans. This has had the perverse incentive of encouraging some farmers to prematurely abandon the insured crop and switch to cash crops, like tobacco.

Farmer groups that had gone through a CFS and follow on adaptation planning were not available to be interviewed during the period of this evaluation. However, in a recent study of a CFS in Pringkuku Sub-district in Pacitan, it appears that the emphasis was specific dryland, planting technique adaptations to drought, which 80% of farmers stated they were increasingly experiencing. Much less emphasized was explaining the science of climatology to the farmers though there was discussion of the increasing uncertainty of seasonal rains as the rationalization for the agricultural adaptation techniques.¹⁸

5. LESSONS LEARNED

The basic model of the SDEWS appears to be very sound:

- Take advantage of well-developed district level government institutions, especially those related to agricultural extension to embed the food crop prediction mechanism.
- Focus on identifying populations and agro-ecological systems with both climate change exposure and high sensitivity. Relatedly, prioritize areas with known tendencies for increasing drought
- Link early warning forecast predictions to the second season cropping calendar where climate related drought risk is very high, especially in ENSO years.

However, as noted above, the climate signal, as provided through more accurate and earlier forecasts is often not sufficient to overcome the structural constraints posed by the requirements of irrigated rice cultivation as well as the inherent agroecological conditions of a given area. Hence, as the District Chief of Indramayu stated, the emphasis should be on joint research with farmers on ways of “climate proofing” both subsistence and cash crop agriculture. As Siregar and Crane put it:

“Understanding the methods and limitations of seasonal forecasting, and climatology in general, is not easy, and it has the potential to be a useful skill. However, taken on its own, improved access to and understanding of climate information does little to strengthen farmers’ capacities to adapt to climate variability because adaptation is embedded in a network of social, technical, and ecological factors with numerous drivers and constraints.”¹⁹

¹⁸ Sundawatiningsih, Harisa. (2012)

¹⁹ Siregar and Crane, p. 64.

District governments need to take better advantage of the farmer field school model to build farmer involvement in crop calendar setting and to experiment with a variety of adaptation models and techniques to better address irregular rainfall and drought. Though the scientists' and technical teams awareness of the impact of higher temperatures on crop productivity exists, it is not clear that this is being systematically addressed in adaptation planning. More importantly, as Siregar and Crane (2011) point out adaptation to climate variability should properly be viewed as a process of social reorganization and negotiation not just technical transformation. Hence, viewing adaptation as a simple knowledge gap that can be filled through more effective scientific communication ignores the social nature of production and the socio-economic dimensions of risk management, especially at the rural farming community level and the historical power relations that are still very important at that level.

According to one analysis in both the Indramayu and Gunung Kidul CFS, participants were more interested in learning specific adaptations, especially water harvesting and improved soil moisture retention techniques.²⁰ Gunung Kidul is just adjacent to Pacitan and agroecological and socio-economic conditions are similar. Stigter and Winarto, looking at the experience of the CFS go further in recommending a more comprehensive restructuring of the CFS and calling for the creation of two different types of intermediary. One intermediary, coming from universities, hydromet services and agricultural specialists would focus on the development of downscaled climate information but especially on expanding the range and types of adaptations as well as training of trainers for the second type of intermediary. The latter would be trained as a facilitator to work with farmer groups to fashion their own group specific learning agenda and course work, which also would conform more closely to the original farmer field schools model.²¹

In both regions, food crop agriculture is becoming less dependent upon paddy rice even though this is still dominant the dominant food crop on Java but is also reinforcing cash crops, other secondary crops and non-farm and off-farm income generation.

Finally, this evaluation strongly recommends that a formal, systematic evaluation be undertaken of the Indonesian climate field schools experience, which is now a decade long, from the standpoint not just of cost-effectiveness but in enriching the knowledge base of climate change impacts throughout Java and in developing adaptation approaches at the farmer group level that can be sustainable in the future.

²⁰ Stigter et al., 2008, "Climate Field Schools in Indonesia: Improving "response farming" to climate change".

6. COMMENTS ON THE EVALUATION METHODOLOGY

Many of the questions proposed in the evaluation guide assume a much greater availability of background information about:

The relationship between IRI and the Bogor Agricultural University team (funding, if any; technical guidance; structure of the program; ongoing institutional relationships, if any). None of this information was made available to the Evaluator.

The historical relationship between the SDEWS and CFS initiatives and the Indonesian National Department of Agriculture as well as the National Council on Climate Change (DNPI) in terms of the development of this initiative. Some of this information was gathered through secondary research.

The Bogor Climate Team provided good information on the scientific basis for the SDEWS but the relationship between that methodology and larger international efforts of a similar nature to strengthen the practical use and further development of downscaled climate data for adaptation planning was absent. The project appeared to be context-free. Subsequent secondary research indicates that the CCROM (where the Climate Team is based) has made a number of efforts to publicize the two initiative through international and regional forums.

The concept of a mid-term evaluation is a very good one but the evaluation guide provided is not a substitute for an actual evaluation scope of work, which it was not. An evaluation scope of work is directly based on the original objectives, methodology and scope for the original project as well as agreed performance indicators, none of which was available to the evaluator, if they, in fact, exist. In fact, with respect to the CFS, it appears that none of these efforts have ever been independently evaluated for their efficacy among other indicators. Given the historical importance and success of the Farmer Field School movement, it would be very worthwhile to carry out such an independent evaluation in order to improve the model and standardize the approach and methodology.

Information about the evaluation (and evaluator) from IRI could have been better. The Bogor team thought I was a Columbia University professor and had never heard of either IRG or the CCRD project.

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