WMO Capacity Development Framework (WCDF)

Purpose of collecting Case Studies: Demonstrate good practices when applying the strategic approach of the WMO Capacity Development Framework (WCDF) to design and implement interventions that support capacity development.

Case Title

Empowering Farmers and Igniting Societal Participation Through Climate Field School Program

Country(ies) involved in the Capacity Development Intervention

Indonesia, Colombo Plan Secretariat (host); Colombo Plan Member Countries including Indonesia and Timor Leste (participants)

Capacity Development Dimension(s) addressed

Institutional ☑; Technological ☑; Information and Services ☑; Human resources ☑

Purpose of the Capacity Development Intervention

Amidst a changing climate, information literacy is important to manage and adapt to the coming risks and impacts of climate change. In particular, there is a significant gap in the understanding of climate-related data and services among the traditional agricultural community that dominates Indonesia, a nation deeply rooted in agriculture.

The Climate Field School (CFS) program is designed to address this lack of understanding of climate information, particularly among the agricultural community. Climate information is a very important part of agricultural operations, dictating optimal planting schedules, cultivation techniques, and harvesting times. This information is critical to maintaining the prosperity and welfare of farmers while supporting national food security by ensuring consistent agricultural yields.

The CFS program embodies a tripartite collaboration between providers (NHMS), intermediaries (agricultural agencies), and end-users (extension workers and farmers). This collaborative effort has been designed to bridge the gap between the technical language of climate information provided by the BMKG (Indonesia's NMHSs), and the everyday language of farmers. In the long term, CFS aims to promote sustainable agribusinesses owned by farmer groups, where climate information is at the heart of strategy and decision-making.

Case description

Step 1: Assess

The implementation of CFS activities by BMKG has been carried out since 2010 through cooperation with the Australian government (AUSAID) and local governments in 2 (two) districts, namely West Lombok, West Nusa Tenggara (NTB), and Kupang, East Nusa Tenggara (NTT). Furthermore, since 2011, BMKG has independently and gradually organized SLI activities. Since 2015, the CFS program has been conducted in all provinces in Indonesia.

The success of CFS activities in enhancing climate understanding and literacy among local government, extension workers, and farmers led to it being designated as a "National Priority" program by the central government in 2018. Until 2023, CFS was implemented in 713 locations in 33 provinces, with a total of more than 20.000 participants. The program has undergone several changes in various perspectives, such as the methodology, curriculum, and most importantly, the transformation of the CFS concept itself.

Step 2: Engage

The evolution of the CFS efforts since its inception has involved considerable collaboration from a variety of sources. From a relatively straightforward initiative characterized by direct collaboration between BMKG (the climate information provider) and local agricultural authorities supervising extension workers and farmers, it has now evolved into a multi-faceted framework involving a wide range of stakeholders. These include academia, local and international non-governmental organizations (NGOs), community groups, industry practitioners, researchers, enterprises, and even overseas weather service partners.

The ethos of the CFS program is underpinned by an unwavering commitment to engaging relevant parties and stakeholders across the full spectrum of agricultural processes and commodity production. By soliciting and integrating multiple perspectives and addressing issues from multiple dimensions, the program aims to enhance the efficiency and accuracy of its outcomes.

Step 3: Design

The original iteration of the CFS concept was divided into two distinct phases, referred to as agricultural outreach and subsequent field engagement, typically tailored to selected groups of farmers or extension workers identified as having potential. The agricultural outreach phase aims to cast a wide net, targeting a broad range of stakeholders, while the subsequent field engagement phase focuses on a more specialized and intensive approach, tailored to specific cohorts of agricultural practitioners. Historically, CFS initiatives have been conducted in different locations each year.

More recently, efforts have been made to streamline services by categorizing CFS into two main types: Thematic CFS and Operational CFS. Thematic CFS represents an evolution from traditional ceremonial outreach activities to more comprehensive multi-stakeholder gatherings focusing on specific thematic issues such as climate change, agricultural practices, disaster management, and forest fire mitigation, or focusing on particular agricultural commodities.

Conversely, operational CFS takes a holistic approach involving field activities over a defined period of time, typically from pre-planting preparations to post-harvest assessments. A designated cohort of farmers or extension workers is paired with representatives from regional agricultural offices and climate analysts, who are tasked with overseeing the cultivation process and using climate information and predictions to optimize crop growth and yield outcomes.

Step 4: Implement

Each iteration of the CFS program is tailored to suit the specific requirements and circumstances of local communities. Nevertheless, there is a standardized set of guidelines or curriculum that serves as a foundational framework, ensuring a minimum standard of quality and consistency across all CFS initiatives, whether ongoing or yet to be implemented.

The CFS curriculum consists of the following themes:

- 1. Understanding of climate information and introduction to weather and climate elements;
- 2. Introduction to weather instruments and their calibration;
- 3. Understanding of rain formation process;
- 4. Understanding of seasonal climate information and forecasting;
- 5. Translating and applying seasonal climate forecasts provided by BMKG, including how to access, read, understand, and apply the climate information and forecasting for agricultural activities;
- 6. Identifying frequent extreme climate events that can affect agriculture yield.
- 7. Understanding of climate classification and land water balance for scheduling the planting and irrigation scheduling;
- 8. Using climate information and forecast as input in the planting strategies (simulation).

One of the key principles in the CFS program is the design of the practice using a Training of Trainer (ToT) approach. The objective is to equip participants with the essential skills to facilitate training sessions or knowledge dissemination to fellow extension workers or farmer collectives. This approach aims to elevate awareness among farmers concerning climate variability or extremes and their implications for agricultural practices.

Step 5: Evaluate

The effectiveness and significance of the CFS initiative are measured by several evaluation criteria, the two most important being the participants' level of understanding and the change in productivity in the target location.

Typically, the change (increase) in participants' understanding of climate information has been evaluated through pre-and post-test scores. Some of the focus materials that were tested were: an understanding of meteorological parameters and phenomena, skill in weather observations using rudimentary instruments, and interpretation of climate prediction products, encompassing variability and monthly seasonal variations. The national average of the participants' level of understanding has shown an increase of about 20-30%.

On the other hand, the outcome of the program will also be evaluated through the measurement of the agricultural productivity in the area where the CFS has taken place. From 2013 to 2023, measurements of CFS productivity were carried out at 89 locations in 18 provinces, resulting in an average increase of yield of up to 30%.

The initiatives undertaken by CFS have gained the recognition and endorsement from multiple prominent members of the societies, such as political figures, including regional leaders such as mayors, regents, and governors, as well as parliamentary representatives, corporations, private companies, subject matter experts, and, most importantly, the agricultural communities themselves, who serve as alumni, have all lent their support and acknowledgment to the program's success.

Application of WCDF Principles

P1: Holistic Approach

Comprehensive collaboration in CFS activities ensures effective planning, implementation, monitoring, and evaluation. Farmers' increased understanding is systematically measured through metrics derived from pre- and post-activity assessments. Additionally, annual Focus Group Discussions (FGDs) are conducted, involving implementers, partners, stakeholders, and participants or alumni of the CFS program. These FGDs serve as platforms for evaluating past activities and collaboratively planning future initiatives.

As part of the CFS and FGD processes, feedback is collected through structured questionnaires targeting both stakeholders and participants. The results from pre-and post-tests, alongside these questionnaires, consistently indicate a significant improvement in farmers' comprehension of climate information and its critical role in agricultural decision-making. Nationally, based on existing calculations, data reveal that CFS participants demonstrate an average increase in understanding of 20-30%.

The positive outcomes of CFS are also reflected in the transformation of planning practices among farmer groups, which now integrate traditional knowledge with modern scientific insights. For instance, while planting schedules traditionally followed local systems like *Pranoto Mongso*, they are now supplemented with crop calendar data from local agricultural services (Dinas Pertanian) and BMKG's climate forecasts and analyses. This holistic approach enhances the precision and resilience of agricultural planning, ensuring better alignment with both local wisdom and scientific advancements.

P2: Sustainability

In terms of resource provision, CFS activities and programs have garnered strong national support, underscored by official backing from the Indonesian government through various mechanisms. The Ministry of Finance and the National Planning Agency (Bappenas) have designated the CFS program as a national priority in the realm of food security. As a result, it is consistently included as a core component in the annual state budget allocation.

Within the broader framework of climate change adaptation, the CFS program has been recognized as a critical element of Indonesia's Climate Resilient Development initiative, which

serves as a guiding framework for climate change control efforts led by the Indonesian government. Additionally, the program has gained significant attention in the regulatory sphere, with members of the House of Representatives routinely monitoring and evaluating its progress during formal hearings with BMKG leadership. Such hearings are officially recorded and published, reflecting a strong, unified commitment to the program's success.

At the local level, several stakeholders have demonstrated substantial support for CFS initiatives. For instance, a state-owned plantation enterprise (PTPN) in the Riau region has participated in multiple collaborations with CFS programs. Similarly, the Food Security Office in East Java Province has been a long-standing partner, actively involved in various CFS activities across the region over the years.

As the scope of the CFS program expands with increasing cooperation proposals, target locations, and participant outreach, challenges in planning and budgeting inevitably arise, particularly in securing adequate funding. To mitigate these risks, implementers employ strategies such as recalibrating targets, optimizing budget allocations, and leveraging cost-sharing mechanisms with involved stakeholders. Over the years, regional CFS implementers have developed considerable expertise in crafting sustainable strategies to ensure the continuity and effectiveness of the program.

P3: Prioritization

The determination of priority targets for CFS activities is based on comprehensive considerations involving implementing agencies, collaboration partners, and on-the-ground conditions. The administrative and logistical responsibilities for CFS activities are typically managed by the BMKG climate office in each province, commonly referred to as a climatology station. These stations serve as central hubs for agricultural and environmental climate-related activities and house teams that identify potential locations for CFS implementation, often based on evaluations conducted in the preceding year.

Priority locations for CFS activities are generally selected based on their significance as food production centers, commonly referred to as food estates. Additionally, other commodities beyond staple crops, such as horticultural products, plantation crops, and livestock, may also be prioritized if they play a critical role in the local economy. The selection process is further supported by local agricultural offices or other relevant government agencies, which possess indepth knowledge of field conditions and maintain comprehensive data on the interplay between agricultural activities and regional economic development.

Through this process, farmer groups equipped with dedicated extension workers are identified, often prioritizing high-performing groups with a demonstrated awareness of best agricultural practices and a proactive approach to enhancing their farming activities. These groups are then selected as participants in CFS activities for the upcoming year. In cases of collaboration with partners such as NGOs or private sector entities, the selection process may adopt more specific criteria developed jointly to align with shared objectives.

Recently, a growing focus has been placed on selecting farmer groups that are particularly vulnerable to climate-related disasters. For example, groups in drought-prone areas, typically characterized by low rainfall, or those in flood-prone regions, such as mountain slopes susceptible to flash floods, have become key targets for CFS initiatives. These activities emphasize the dissemination and application of early warning systems for extreme weather and drought

conditions. Vulnerable farmer groups rely heavily on disaster-related information, as their crop yields are directly impacted by their ability to implement effective mitigation strategies.

P4: Efficiency and Innovation

Data from the 2023 implementation of CFS activities indicates a significant overachievement of planned targets, with participant numbers reaching 120% and location coverage at 132% of the initial projections. This success is attributed to the effective cost-sharing mechanisms established with implementation partners beyond the government's allocated budget for BMKG. In 2023, 57% of the total funding for CFS activities came from government resources, while the remaining 43% was contributed by various collaborators, including NGOs, private sector entities, stakeholder partners, and international assistance such as South-South Cooperation initiatives.

Between 2011 and 2023, the number of participants and locations involved in CFS activities has shown fluctuations; however, the overall trend has been upward, reflecting increasing efficiency in program implementation. A pivotal moment occurred in 2016 when the CFS business process transitioned from a purely socialization approach to a collaborative, practice-oriented model. This shift led to a significant reduction in budget requirements due to the introduction of a joint implementation scheme, which simultaneously increased participant engagement. Enhanced budget efficiency, innovative methodologies, and growing interest from collaborative partners have driven this positive trajectory. Data from the last five years, particularly in the post-pandemic period, highlights a marked improvement in cost efficiency, with notable reductions in cost per participant and cost per activity.

Since the onset of the COVID-19 pandemic in 2020, the CFS program has increasingly embraced technology to enhance its reach and effectiveness. A landmark achievement during this period was the recognition of the InfoBMKG application, which won the WMO award in the government application category in 2020. The InfoBMKG app serves as a robust platform for monitoring weather information and provides reliable real-time weather and climate predictions. Its widespread introduction through CFS activities aims to empower farmers, extension workers, and agricultural practitioners to seamlessly access and utilize critical meteorological data for informed decision-making in agricultural practices.

Additionally, other technological innovations have been systematically integrated into CFS activities. The Kimono-CFS application, a comprehensive support tool and activity database for a single planting season, has been introduced to enhance operational efficiency. The AR SLI application, which employs augmented reality technology, has further elevated the appeal of CFS programs by enabling users to interactively explore meteorological information, understand atmospheric processes, and familiarize themselves with meteorological instruments through their smartphones. These technological advancements collectively enhance the accessibility, efficiency, and engagement of CFS initiatives.

P5: Cooperation, equity, and inclusion

The implementation of CFS activities consistently prioritizes gender balance in participant composition. In Indonesia, agricultural activities traditionally involve women during some steps at various stages, from planning to post-harvest utilization. Therefore, ensuring that climate information dissemination in CFS programs reaches diverse demographic groups, including

women, is essential. Annually, female participants constitute approximately 20–30% of total participants. Between 2011 and 2021, data indicate a steady increase in women's participation, averaging a 15–20% growth per year, despite occasional fluctuations across locations and activities. These trends reflect the program's commitment to inclusivity and its adherence to comprehensive, gender-sensitive principles.

CFS activities are designed to accommodate all scales and types of agricultural operations. In developing countries like Indonesia, the majority of farmers are smallholders with limited financial resources. Consequently, this demographic remains the primary focus of CFS initiatives, with the dual aim of enhancing their climate literacy and improving their economic well-being. While collaboration with large-scale farmers also occurs, it typically takes the form of partnerships with private-sector-supported or NGO-affiliated farmer groups.

Additionally, CFS programs target specific community clusters to broaden their outreach and impact. These include youth groups, watershed management communities, academic networks, and others. CFS adopts a Penta helix collaboration model, fostering partnerships among government, private sector, academia, media, and community stakeholders. This approach ensures efficient resource allocation, synchronized programming, and shared objectives. For instance, the longstanding partnership between BMKG and the NGO Konsepsi in West Nusa Tenggara exemplifies this model. Over the past five years, this collaboration has integrated various stakeholders, including academics, media outlets, local governments, and other entities, to support a wide range of community groups with diverse CFS activity themes. Financial backing for these efforts comes from both government allocations and external funding sources, ensuring sustainability and expanded reach.

P6: Result-based CD

The success of the CFS program is currently evaluated based on several key factors. As previously outlined, the most critical metric remains the improvement in farmers' understanding of climate information for agricultural purposes. Another significant positive outcome is the observed increase in productivity, which has been measured across several locations and commodities. This includes both productivity gains compared to prior periods and relative improvements over neighboring areas not yet exposed to CFS interventions. Such productivity growth is a tangible indicator of the economic benefits experienced by program alumni.

Additionally, a key derivative benefit of understanding climate information is reducing crop failure risks. Early warning systems, a crucial component of climate information, enable farmers to anticipate and mitigate the effects of a local type of drought (puso) and flooding in crop production areas. On a macroeconomic scale, mitigating such disasters has a direct correlation with controlling inflation, both locally and nationally.

This aspect has garnered particular attention from Bank Indonesia, the nation's central bank, which plays a pivotal role in managing food-related inflation. BMKG collaborates at the national level to provide essential climate information through a dedicated portal and participates in routine meetings, often focused on preparing for significant climate phenomena such as ENSO. These collaborations are also implemented at the regional level. For example, the Bank Indonesia representative office in West Sumatra has partnered with BMKG for several years to address local inflation challenges within the CFS framework. Similarly, in Kupang, Bank Indonesia's local office

has worked with youth and student organizations to tackle food security issues through the Thematic CFS programs.

Other notable and sustainable initiatives include the CFS program for coffee commodities in Bali and Nusa Tenggara, conducted in collaboration with the NGO Su-re.co. Likewise, the CFS program for cocoa commodities in Sabang, Aceh, involves partnerships with local community forums and cocoa farmers. Both initiatives have successfully established sustainable business processes, extending into the commercial supply chain and delivering mutual benefits to all stakeholders involved.

Lessons learned and recommendations for wider application

Over more than a decade, CFS activities have educated numerous farmers in understanding the weather, climate information, and new farming techniques to plant different crops, tailored to optimize crop selection under prevailing climatic conditions, thereby reducing the risk of crop failure due to climate impact and enhancing their crops productivity and their income. CFS activities also successfully developed effective methods for disseminating climate information and forecasts to end-users, particularly farmers. The involvement of intermediaries, in this case, the agricultural field officers, plays a pivotal role in translating complex climate information into accessible insights for farmers.

By integrating a training of trainers (ToT) approach into the CFS, participants are equipped with the necessary skills and knowledge to effectively disseminate information to farmers in their respective regions. This ToT approach not only ensures the sustainability and scalability of the program but also empowers local stakeholders to act as educators and champions for climate-smart agriculture. This empowerment strengthens community resilience and promotes the development of sustainable adaptation strategies.

Based on the CFS experiences, the activities of CFS can be conducted by engaging numerous stakeholders that enable expanded collaboration and cost efficiency through the sharing of resources, such as expenses, infrastructure, facilitators, etc. Some instances of notable collaboration are the implementation of synergy between CFS and Ecosystem-based Adaptation (EBA), to facilitate the adaptation of individuals, particularly farmers, to climate change, through a proactive utilization of biodiversity and ecosystem services.

The recently concluded major pandemic event has also brought about transformation within the CFS program. Initially involving direct engagement with farmers and stakeholders, CFS has transitioned to the "new normal" concept due to the global spread of the COVID-19 pandemic. This shift prompted policy changes in CFS activities. Despite the challenges, the program persevered by transitioning to digital platforms such as online Zoom meetings, the utilization of digital videos and modules, and online group communications. Other transitions of this concept were the implementation of health protocols during CFS activities, such as maintaining physical distance, hand hygiene, and wearing masks. This experience has taught us that the delivery of CFS can extend beyond direct engagement to include online learning platforms.

Further development is essential to enhance the quality program and expand the scope of CFS initiatives. Among the areas to be explored for CFS is the adoption of the Climate Smart

Agriculture (CSA) concept and further implementation of Ecosystem-Based Adaptation (EBA). Ongoing implementations of CSA include the development of a low-cost and independentlyengineered Automatic Weather Station (AWS) and its integration with an online database, which is accessible through a versatile mobile application known as KIMONO-CFS.