Enhancing agricultural productivity and food security with tailored decision-making seasonal climate information

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Paper presented at the Workshop on Objective Climate Forecasts for Agriculture and Food Security Sector in Eastern and Southern Africa in Victoria Falls, Zimbabwe from 30 August – 4 September 2021

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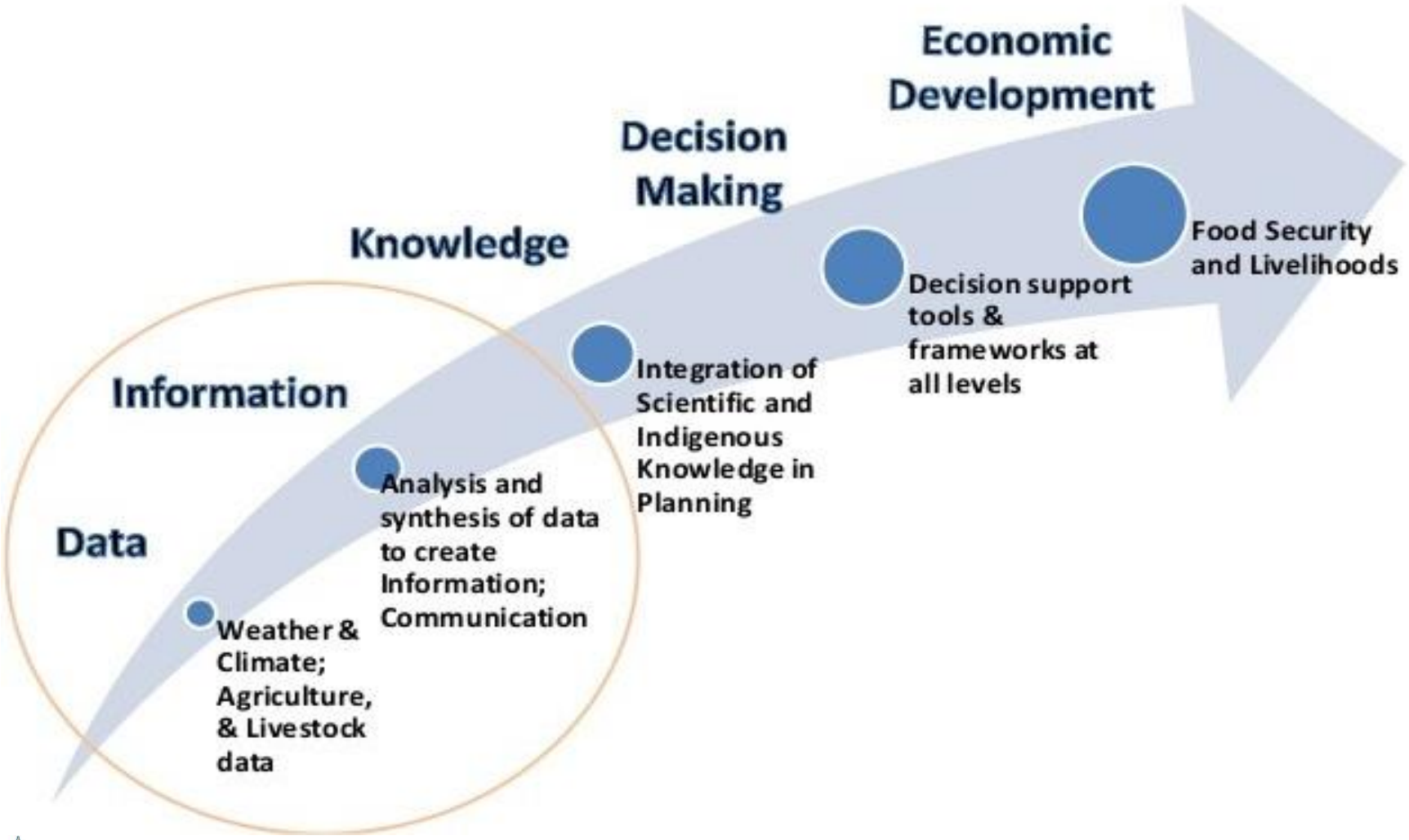
Projection of the goal of the Workshop



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Background

- **Agriculture and food security are closely linked to weather and climate conditions and adverse weather and climate conditions directly affect agricultural productivity**

- **Extreme weather, climate variability, and long-term climate change pose important challenges to future agriculture and food security**

- **Seasonal Climate Forecasts provide vital information for governments and stakeholders to make informed decisions in climate-sensitive sectors such as agriculture and food security**

- **This Workshop provides an opportunity to incorporate tailored decision-making seasonal climate information into agricultural development through a holistic integration of climate services into practices and policy for development decisions in agriculture and food security (Agricultural System Value Chain).**

Background

- **Agricultural systems that wisely use tailored climate information can help to make better informed decisions at policy, institutional and community levels that improves the efficient use of limited resources, and increases crop, livestock and fisheries production by reducing impacts of climate risks and enhancing opportunities**

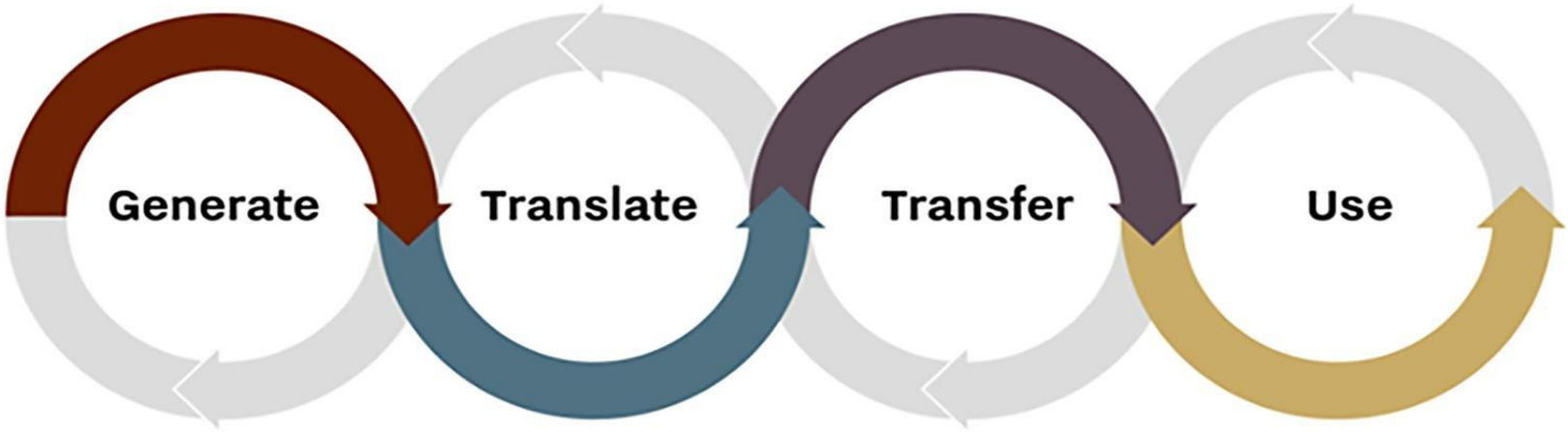
- **Seasonal climate early warning systems can inform governments and decision makers of upcoming food security crises months before the situation develops into a famine to ensure timely action**

- **Advance tailored climate information can help to optimize the farm level activities and improve efficient use of inputs**

Background

■ Generate climate information and knowledge - learn from the past, monitor the present, forecast the future.

■ Transfer the translated information to the appropriate beneficiaries, in formats and media most useful to their operations



■ Translate the climate knowledge into Information that is relevant to agriculture, public health and other target sectors.

■ Put the translated and transferred climate knowledge to use in operational decision processes, policies and plans. Learn what works and what doesn't.

Linear value chain approach to climate services showing loops of interaction that link users to producers with the grey loops showing engagement at the generation phase

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Climate information products and services needs for development planning in agricultural sector

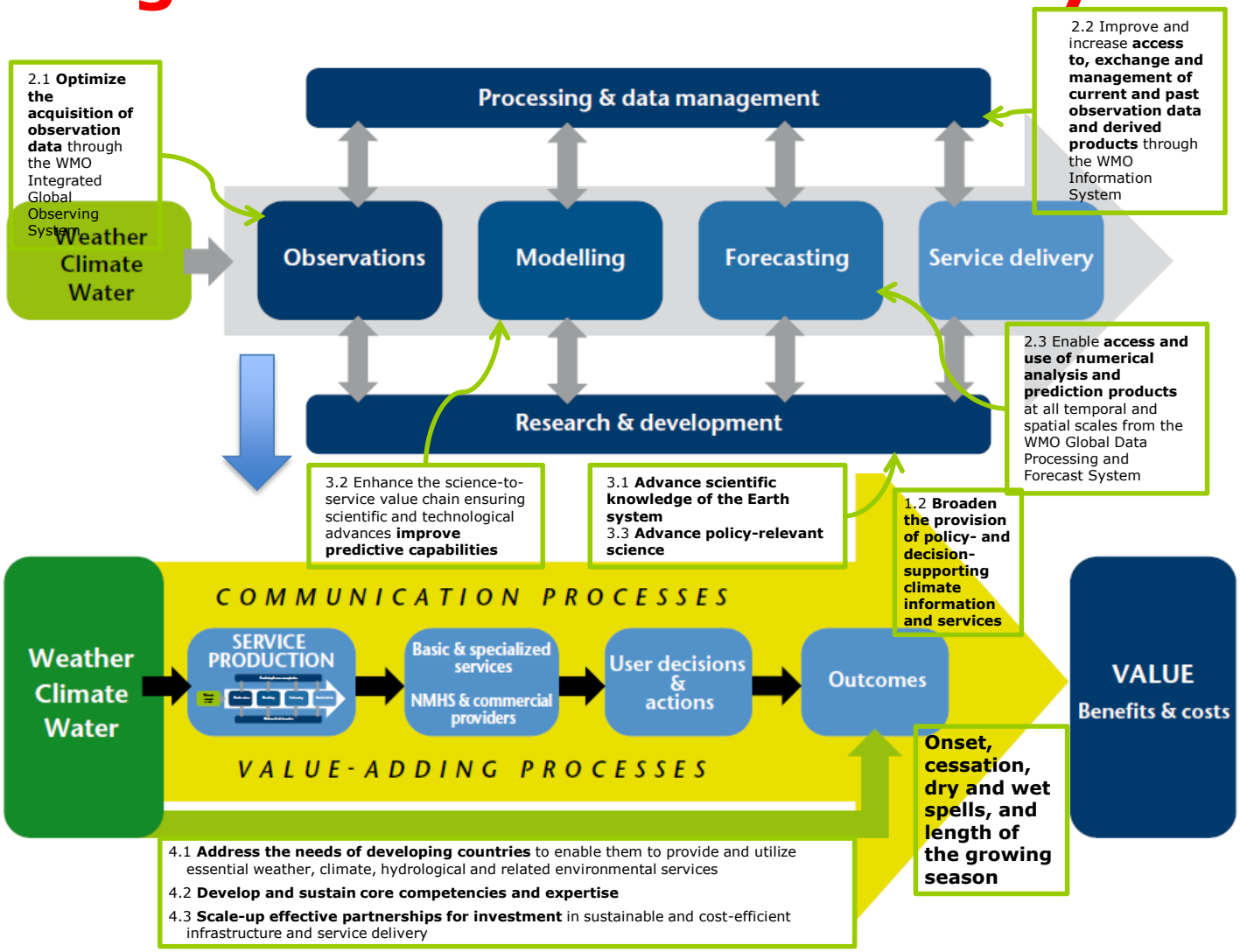
- **Climate information products and services for agriculture extend to where it can help develop sustainable and economically viable agricultural systems, improve production and quality, reduce losses and risks, decrease costs, increase efficiency in the use of water, labour and energy, conserve natural resources and decrease pollution by agricultural chemicals or other agents that contribute to the degradation of the environment**

- **The agriculture and food security community relies on appropriate and timely phenological, environmental, and climate information at relevant spatial and time-scale data points to make informed decisions**

- **Available, accessible, comprehensive and useful weather and climate information can help agriculture and food security decision-makers improve their understanding of climate's impact on agricultural development and food systems, and their estimates of populations at risk (risk mapping)**

- **Weather and climate information can be particularly helpful to anticipate, prepare for and respond to agriculture or food security risks, on both short time scales to address problems triggered by climate extremes (i.e., droughts, thermal extremes) as well as longer term risks associated with climate change (e.g. desertification).**

Climate services value chain for Agriculture & Food Security



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Understanding user needs for climate services in agriculture

- **Agricultural extension services provide technical guidance to farmers and are typically under the administration of each country's ministry of agriculture**

- **These extension services also provide useful climate information to farmers in coordination with National Meteorological and Hydrological Services (NMHSs)**

- **3 Main climate services required for the agriculture sector:**
  - **Assessment of extreme weather and climate events**

    (Specialists use statistics on the frequency, duration and intensity of extreme weather and climate events and their expected changes to make informed decisions)

  - **Climate predictions:** *(Climate predictions on monthly to seasonal to decadal time scales help with decisions on which variety to plant and when, how much water is needed for irrigation, when and where disease outbreaks are likely to occur, or whether to reduce livestock numbers in case of drought)*

  - **Climate change projections:** *(to indicate precipitation and temperature patterns in the time frame of 30–50 years)*

Decision-making based on tailored seasonal climate information

- **Intra- and inter-seasonal variability has a major impact on agriculture and food security**

- **Seasonal climate outlooks can influence decisions on which varieties to plant and when, or the best timing for spraying where plant disease outbreaks are likely to occur, or perhaps estimate the quantity of water needed for irrigation or whether to reduce livestock numbers if a drought is forecast**

- **Farmers may be unprepared for expected weather conditions and make decisions based on an understanding of general climate patterns in their regions.**

- **Better climate predictions three to six months in advance can help shape appropriate decisions, reduce impact and take advantage of forecasted favourable conditions.**

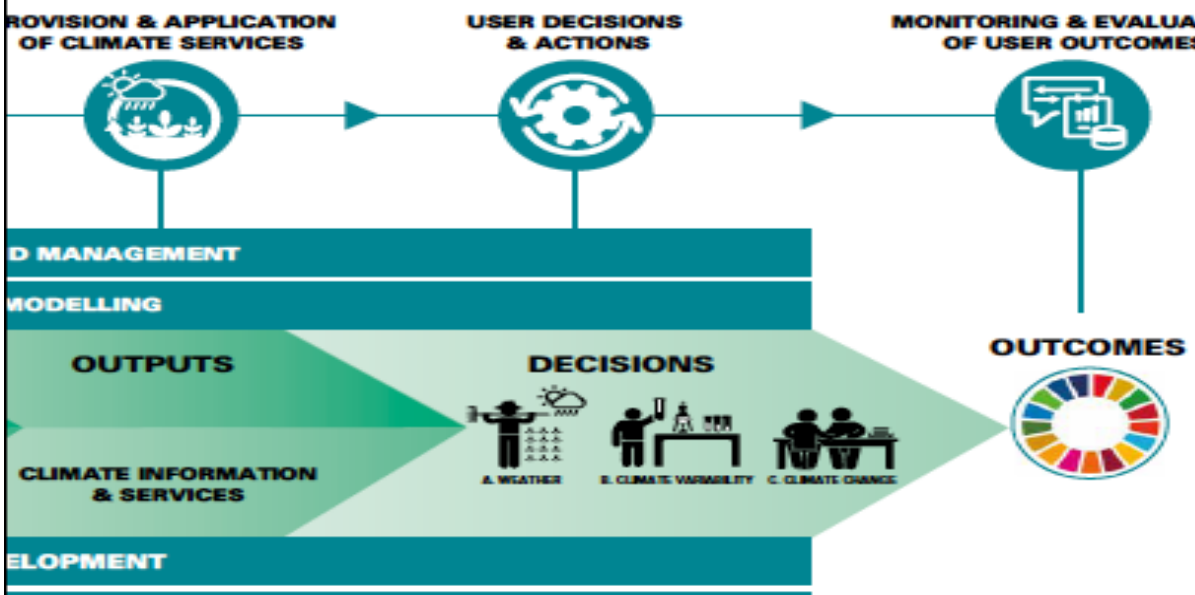
Decision-making based on tailored seasonal climate information

Seasonal forecasts provide probability distribution for monthly to seasonal means of climate parameters (in terms of their departures from long-term averages), such as rainfall and temperature, several months in advance that can be used for crop yield estimates. Yet, information about growing season weather beyond the seasonal average is also needed, such as growing degree days, changes in the growing season, etc.

RCCs jointly access forecasts based on such teleconnections (ENSO) and Canonical methods through the Regional Climate Outlook Forums (RCOF), and develop a consensus-based seasonal climate outlook. For example, a seasonal rainfall forecast, delineates areas of expected rainfall anomalies in probabilistic form, in tercile categories (above-normal, normal and below-normal)

The objective consolidated forecast uses global dynamical models which are statistically downscaled using ensemble linear regression technique and Canonical Correlation Analysis as implemented in the Climate Predictability Tool

Climate Services for Agriculture including crops, fisheries, forestry and livestock



OUTPUTS

A. Weather
- Days suitable for fieldwork
- Accumulated growing degree days for season
- Heat indices for livestock
- Fire Danger Ratings
- Pest/Disease Forecasts

B. Climate Variability
- Crop-yield forecasts
- Average dates of beginning and end of rainy season
- Average first and last frost dates
- Crop-Weather Calendar
- Drought Indices/Warnings

C. Climate Change
- Maps of changes in agroecological zoning
- Maps of changes in first/last frost dates
- Analyses on future crop impacts

USER DECISIONS AND ACTIONS
- When to plant and harvest
- When to irrigate
- When to apply fertilizers/ pesticides
- When to rotate/move live stock
- Investing in drought resilient crops and livestock
- Investing in more efficient irrigation systems

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Tailored product co-design and operationalization

Service delivery track	System operationalization track
Identification of priority products and services across sub-region (e.g. from national plans, NDCs, etc.)	Assess NMHS and WMO regional centre systems and services to identify capacity development and technical assistance needs
Regional sector-specific workshops/processes to develop tailored product specifications	Design/propose measures to enhance data and products availability through greater systems operationalization on sub-regional scales
Preparation of additional national datasets as needed for tailored products	Use Regional Climate Forums (RCFs) to plan and prepare for operational release of priority tailored products identified under the service delivery track
Country-level service delivery system/communication channels identified/established (NMHS partnership with sector stakeholders)	Introduce priority products operationally at national level, with support from the WMO Regional Centre and GPCLRFs
Delivery of tailored products and user feedback	Assimilation of feedback for forecast system and tailored product improvements
Assessment of socio-economic benefits (essential for sustainability)	Assessment of country-level climate services capacity improvements

Decision-making based on tailored seasonal climate information

- **Research and Modelling and Prediction are crucial and strong developmental links to joint climate and agriculture and food security applications, studies and metrics, and to creating new products and services for the needs of the agriculture and food security communities**.

- **Climate outlooks often use probabilistic measures, but interpreting them for effective decision-making requires new paradigms. Complication arises when users of climate services have difficulty relating science-based forecasts and outlooks with those obtained from traditional (indigenous) methods.**

- **Greater collaboration is needed to bring the scientific and indigenous worldviews together in the delivery of climate services**

- **Capacity Building can significantly enhance training activity to serve as a bridge between science and technology on the one hand and the decision-makers on the other** *(linking knowledge awareness, training, interdisciplinary work, and outreach)*

Policy makers – User Community Linkages and related Platform

- **User Interface Platform (UIP) pillar will help bring together the many participants in agricultural and food security sectors, providing a structured means for users, user representatives, climate researchers and operational climate service providers to interact and co-design products**

4 Outcomes of a successful user interface

- **Feedback: Identifying the optimal methods for obtaining feedback from user communities**

- ***Conduct stakeholder mapping (scale diagram, with decision points for each stakeholder, tactical and strategic, for each agricultural industry), including classifying stakeholders;***

- ***Reduce top-down approaches and improve bottom-up efforts recall that the agriculture sector is large and diverse, and that complex impacts are often felt at local scales;***

- ***Identify users in the whole supply chain of the agriculture industry (with livestock, fisheries (both aquaculture and capture)), sugar, and forestry interests and extension officers, farmers, policy makers, researchers, NGOs, media, insurance and finance, and transport;***

- ***Devise ways of interacting continuously and sustainably with users (Climate Outlook Fora, for example are often only "occasional'').***

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Policy makers – User Community Linkages and related Platform

- **Dialogue: Building dialogue between climate service users and those responsible for the observation, research and information system**

- *Develop better, multidisciplinary linkages*
- *Encourage free exchange of data and climate information*

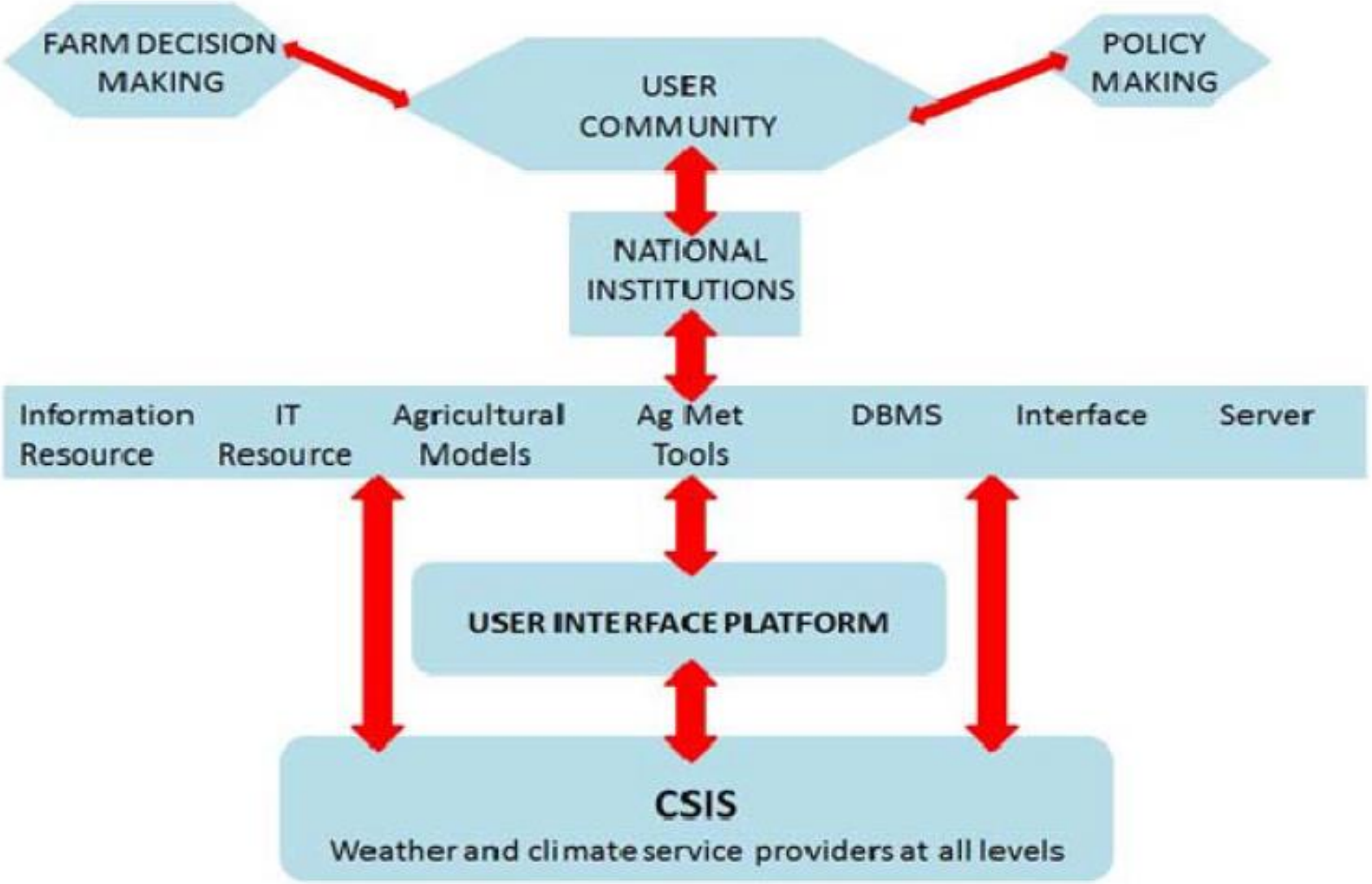
- **Outreach: Improving climate literacy in the user community, and literacy of the climate community in user needs:**

- *Ensure provision of climate inputs to, and participation in, vulnerability mapping;*
- *Conduct hazard mapping and crop zonation mapping;*
- *Mobilize users to be more active in use and dissemination of climate information;*
- *Consider what is appropriate for risk management and for adaptation (processes differ for these time scales).*

- **Evaluation: Developing monitoring and evaluation measures that are agreed between users and providers:**

- *The climate-agriculture interface should be well developed at all appropriate levels including policy, investment, operational, East-West operational, etc.);*
- *Develop an appropriate structure for each level;*
- *Categorize mechanisms;*
- *Identify existing mechanisms from a sector basis;*
- *Institutionalize mechanisms and policies*

Types of UIP products for decision-makers



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Socio-economic benefits of tailored seasonal climate information to agriculture and food security

Climate information is applied in policy making, strategic and tactical planning aimed at the overall national well being of individuals, consumers, and commerce and industry.

Actions at Governmental level could be the optimisation of trading opportunities and control of imports and exports, strengthening of distribution systems, change of taxation and subsidies, and mitigation of or adaptation to large scale problems/disasters such as epidemics, seawater inundation, floods, drought, and desertification

Climate information can also assist policy making in intra-sectorial matters (e.g. use of renewable or man-made energy systems, choice of transport systems) and in inter-sectorial matters (e.g. water for power or agricultural use).

Specific measures of benefit would be increased national trade margins (or reduced gaps), reduced hazard related deaths, more accurate benefit to cost ratios of different mitigative/adaptive strategies.

Socio-economic benefits of tailored seasonal climate information to agriculture and food security

- **Accurate season climate forecasts help farm management decisions: These include:**
  - **careful management of planting times**
  - **determining the area and crop variety to plant**
  - **controlling stocking rates**
  - **pre-empting health issues in livestock**
  - **managing water and fertiliser applications**
  - **optimising harvesting times.**

- **The value that improved seasonal climate forecasts bring to the agriculture sector is likely to have flow on benefits, and multiplier effects for local rural communities.**
  - **An increase in farmer incomes, and a decrease in variability of incomes, is generally beneficial for local communities.**

Takeaway Message

- **Develop effective partnerships and dialogue between climate service and agriculture and food security users at all levels to enhance the climate resiliency of the agriculture and food security community/sector;**

- **Monitor and respond to the evolving needs of agriculture and food security community/sector by developing and working to mainstream climate services into core agriculture functions (i.e., phenology, crop surveillance, preparedness and risk management, multi-sectorial food security);**

- **Support agriculture decision-makers with appropriate and timely information and services to integrate environmental and climate factors into agriculture planning strategies and practice processes at the national, regional, and global levels;**

- **Enhance operational and technical cooperation on environmental, disaster risk and climate matters, and undertake joint actions to support sustainable agriculture and food security.**

Takeaway Message

We have learnt a lot and now know how to plan our planting and harvesting according to weather and climate conditions. Before we relied on knowledge passed down from our parents. But the weather is different from what it used to be and so traditional knowledge is no longer sufficient."

CLIMATE FIELD SCHOOL PARTICIPANT
Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG)

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Thank you!

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