

•REPORT 2015:02

**Institutional Analysis for Climate Services
Development and Delivery in Tanzania**



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May 2015

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Title: Institutional Analysis for Climate Services Development and Delivery in Tanzania

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CICERO Report 2015:02

Financed by: The Norwegian Ministry of Foreign Affairs

Project: Global Framework for Climate Services Adaptation Programme in Africa

Project Manager: Bob van Oort

Quality Manager: Stine Aakre

Keywords: Climate services; Institutions; Tanzania; Adaptation; Climate change

Abstract: This report is an output of the Global Framework for Climate Services (GFCS) Adaptation Programme in Africa. The goal of the report is to describe and assess the current institutional landscape for development and delivery of climate services in Tanzania and to suggest pathways for leveraging current opportunities, as well as for addressing current institutional barriers, to enable improved production, access, and use of climate services in Tanzania. This report is based on a review of relevant policy documents and grey literature, focus group discussions with communities in Longido and Kiteto Districts, and key informant interviews with selected policy-makers, authorities, and non-governmental actors at national and district levels involved in the fields of agriculture and food security, health, and disaster risk reduction and management. The report findings suggest that there are four major institutional challenges to the delivery of usable climate services across institutional scales in Tanzania: 1) potential mismatches between national institutional arrangements and legal mandates, 2) limited technical, financial, and human resources, 3) lack of sufficient mechanisms to facilitate systematic flows of information between government agencies, both vertically and horizontally, and 4) limited specialized climate change knowledge and expertise within government structures. Recommendations are made for addressing these challenges.

Language of Report: English

Cover photo credit: Jennifer J. West

Rapporten kan bestilles fra:
CICERO Senter for klimaforskning
P.B. 1129 Blindern
0318 Oslo

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Acronyms

AU	African Union
CCCS	Centre for Climate Change Studies
CICERO	Centre for International Climate and Environmental Research – Oslo
DM	Disaster Management
DRR	Disaster Risk Reduction
EAC	East African Community
FGD	Focus Group Discussion
GFCS	Global Framework for Climate Services
IIED	International Institute for Environment and Development
IK	Indigenous Knowledge
IPCC	Intergovernmental Panel on Climate Change
JICA	Japanese International Cooperation Agency
MAFC	Ministry of Agriculture, Food Security, and Cooperatives
MAM	March-April-May Season
MLFD	Ministry of Livestock and Fisheries Development
MLHHSDD	Ministry of Lands, Housing, and Human Settlements Development
MoW	Ministry of Water
MoHSW	Ministry of Health and Social Welfare
NEMC	National Environment Management Council
NGO	Non-governmental Organization
OND	October-November-December Season
PMO – DMD	Prime Minister’s Office – Disaster Management Department
RBA	River Basin Authority
SADC	South African Development Community
TANDREC	Tanzania Disaster Management Committee
TMA	Tanzania Meteorological Agency
UDSM	University of Dar es Salaam
UNFCCC	United Nations Framework Convention on Climate Change
VPO – DoE	Vice President’s Office – Division of Environment



Contents

- Institutional Analysis for Climate Services Development and Delivery in Tanzania..... 1
- 1 Executive summary 1
- 2 Background and Rationale for the Study 2
- 3 Approach..... 3
- 4 Results and Discussion 5
 - 4.1 PRODUCTION OF CLIMATE AND METEOROLOGICAL INFORMATION 5
 - 4.2 MAIN USERS AND APPLICATIONS OF CLIMATE AND METEOROLOGICAL INFORMATION..... 7
 - 4.3 TRANSMISSION, TRANSLATION, AND DELIVERY OF CLIMATE INFORMATION 12
 - 4.4 RESPONDENT VIEWS ON THE TIMELINESS, SALIENCE, AND CREDIBILITY OF CLIMATE INFORMATION 13
 - 4.5 LIMITATIONS AND CHALLENGES FACING CLIMATE INFORMATION PROVIDERS..... 15
 - 4.6 MAINSTREAMING CLIMATE VARIABILITY AND CHANGE INTO NATIONAL SECTORIAL AND DISTRICT POLICIES AND PLANS..... 20
 - 4.7 PERSONNEL AND BUDGETARY RESOURCES FOR ADDRESSING CLIMATE CHANGE..... 20
 - 4.8 INTERNATIONAL INFLUENCE ON CLIMATE ADAPTATION AND MITIGATION EFFORTS..... 22
 - 4.9 NON-STATE CLIMATE CHANGE INITIATIVES IN LONGIDO AND KITETO DISTRICTS..... 22
- 5 Conclusion 23
- APPENDIX I: Main public institutions involved in climate information and service provision 26
- APPENDIX II: Key informant interview checklist 29
- APPENDIX III: Guiding questions for focus group discussions 31
- APPENDIX IV: Roles of Key Informants Interviewed at District Level..... 32
- APPENDIX V: Roles of Additional Key Informants Interviewed at National and District Levels 33

CICERO Report 2015:02

Institutional Analysis for Climate Services Development and Delivery in Tanzania

1 Executive summary

This report describes and assesses the current institutional landscape for development and delivery of climate services in Tanzania. The findings draw on a review of relevant policy documents and grey literature, focus group discussions (FGD) with communities in Longido and Kiteto Districts, and key informant interviews with selected policy-makers, authorities, and non-state actors at national and district levels involved in the fields of agriculture and food security, health, and disaster risk reduction and management. Interviews and FGD aimed to understand the institutional processes, relationships, and constraints that shape the ways in which climate information is currently produced, communicated, and delivered and to gauge respondents' perceptions of the salience, legitimacy, and credibility of climate information for decision-making. The findings suggest that there are four major institutional challenges to the delivery of usable climate services across scales in Tanzania: 1) potential mismatches between national institutional arrangements and legal mandates, 2) limited technical, financial, and human resources, 3) lack of sufficient mechanisms to facilitate systematic flows of information between government agencies, both vertically and horizontally, and 4) limited specialized climate change knowledge and expertise within government structures, at national and sub-national levels. Based on these challenges, the following actions are recommended: 1) review and evaluate Tanzania Meteorological Agency's (TMA) current institutional position and associated mandates to ensure that these can effectively support the development of climate services, 2) develop sustainable institutional mechanisms for increased interaction between producers/users of climate services to enhance co-production capacities, 3) conduct further studies of how indigenous and scientific knowledge can be integrated to improve credibility, salience, and legitimacy of climate information across scales, and 4) enhance technical expertise and knowledge of climate change within government institutions at national and sub-national levels.

2 Background and Rationale for the Study

This report has been prepared by the Centre for Climate Change Studies (CCCS) at the University of Dar Es Salaam (UDSM) and the Center for International Climate and Environmental Research – Oslo (CICERO) as a deliverable to the Global Framework for Climate Services (GFCS) Adaptation Programme in Africa, a multi-sectorial pilot initiative that seeks to develop user-driven climate services for food security, health, and disaster risk reduction in Malawi and Tanzania.¹ The report aims to provide insights that can inform the design of a national climate services system in Tanzania that is capable of developing and delivering timely, salient, credible, legitimate and actionable climate and meteorological information to a range of end-users.

Climate variability and change pose a range of threats to national development and natural resource-based livelihoods in Tanzania.² In this context, climate services can play a key role in facilitating adaptation to climate variability and change. Climate services refer to scientifically based information and products that enhance users' knowledge and understanding about the impacts of climate on their decisions and actions³. In addition to including climate-related data and information, a climate service includes the associated information and assistance that is needed to interpret and use these data⁴. They are most effectively developed and applied through

¹ See http://www.gfcs-climate.org/CSA_Africa

² URT. (2007). National Adaptation Programme of Action (NAPA). Vice President's Office, Division of Environment. Accessed July 31, 2013 at: <http://unfccc.int/resource/docs/napa/tza01.pdf>.

³ American Meteorological Society (2005)

⁴ The European Union (EU) Roadmap for Climate Services (2015) defines climate services as 'transformation of climate-related data — together with other relevant information — into customized products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large. As such, these services include data, information and knowledge that support adaptation, mitigation and disaster risk management' (EU, 2015:10).

collaboration between providers and users of climate information.⁵ Yet, designing, developing, and delivering climate services that meet the needs of a variety of end-users is a challenging task. Producing information that is timely, credible, and actionable necessitates inputs from many players, and requires close communication, coordination, and liaison between multiple institutions and stakeholders at different levels.⁶ The large potential number of actors and stakeholders involved stems from the fact that climate change is a crosscutting and complex challenge. While TMA plays a pivotal lead role in this institutional landscape, it cannot perform the task alone. The aim of this study is to undertake a thorough assessment of current institutions involved in the production, supply, communication, and application of climate information for decision-making at the national and selected district levels (Longido and Kiteto) in Tanzania. The study targeted decision-makers within the agriculture and food security, health, and disaster risk reduction and management sectors. The findings of this analysis are expected to assist TMA and its collaborating institutions in developing fruitful relations within the institutional set-up in its entirety in order to facilitate the design and functioning of a national climate services system.

3 Approach

In order to map and assess the institutional landscape in Tanzania pertaining to climate services development and delivery, the study draws on a review of relevant policy documents and grey literature and stakeholder interviews conducted at national and sub-national levels. The reviewed documents include national sectorial climate relevant policies, plans, strategies and programs. Also, district socio-economic profiles, budget plans and climate change-related project brochures were reviewed. Interview checklists were used to guide interviews with key informants at national and District levels, and focus group discussions (FGD) with communities in Longido and Kiteto Districts (Appendices II and III). One village in each of the two focal

⁵ See e.g. CDKN, 2014. Exploring the role of climate science in supporting long-term adaptation and decision-making in sub-Saharan Africa. Accessed 10.10.14 at http://cdkn.org/resource/fcfa_background/

⁶ Vaughan, C., & Dessai, S. (2014). Climate services for society: origins, institutional arrangements, and design elements for an evaluation framework. *Wiley Interdisciplinary Reviews: Climate Change*, 5(5), 587-603. doi: 10.1002/wcc.290

districts (Longido and Kiteto) was selected for a FGD to gauge selected community members' perceptions of the timeliness, salience, and credibility of the climate information they are currently able to access. The selected villages were Kimokouwa village in Longido district and Ilera village in Kiteto district. The selection of these villages was based on their engagement with and reliance on agriculture and livestock keeping, which are sensitive to climate variability and change. Geographic location was also a determining factor in selecting the villages in terms of gaining access to the villages. FGD sessions at the village level involved eight to twelve participants, including village government leaders and community members. The community members were selected purposely with the help of village government leaders based on participants' knowledge about local agricultural and livestock-keeping challenges, the ways in which climate variability impacts on households' agricultural decisions and planning and their knowledge of local and/or scientific weather forecasts and climate information and observations. Key informant interviews at national and district levels elicited respondents' views on the institutional landscape in Tanzania pertaining to climate services development and delivery and sought information regarding institutional coordination (horizontal and vertical), and non-governmental organizations' involvement in climate services development and delivery. The targeted key informants included relevant heads of departments at District Councils and within Central Government Ministries, as well as selected non-state organizations and agencies within the two districts. At the national level, the institutions covered include TMA, the Vice President's Office – Division of Environment (VPO-DoE); Prime Minister's Office – Disaster Management Department (PMO-DMD); Ministry of Water (River Basin Authorities); Ministry of Agriculture, Food Security and Cooperatives (MAFC); Ministry of Livestock and Fisheries Development (MLFD); Ministry of Lands, Housing, and Human Settlements Development (MLHHS); and the National Environment Management Council (NEMC). At the sub-national level, the study focused on two districts (Longido and Kiteto) for which a range of public civil servants and selected non-government institutions operating in the two districts were consulted.

4 Results and Discussion

4.1 Production of climate and meteorological information

At the national level, production of climate and meteorological information in Tanzania is mainly done by TMA, which is located within the Ministry of Transport. However, there are a range of institutions both at national and sub-national (district and local) levels that have a stake in the production and application of climate and meteorological information. A detailed description of the institutions and the type of climate and meteorological information that they generate is contained in Appendix 1 to this report, while a summary of the main users and applications of this data are contained in Tables 1 (national level) and 2 (district level) on pp. 9-16 of this report. At the national level, relevant institutions involved in the production of climate information and services include the MoW and RBAs, MAFC, MLFD, MLHSD, VPO – DoE, PMO – DMD, and NEMC also have a stake in the production of climate services, such as national climate change assessment reports, warnings on long- and short-term climate and extreme events, climate-related brochures, and various advisories to the public (see Section 4.6 for further discussion of institutional mandates related to production and application of climate information).

While TMA produces a wide range of climate and meteorological information, other national and sub-national institutions produce mainly rainfall-related information. For example, at Kiteto District Council, the MoW, through the Pangani RBA, has an office that is responsible for collecting rainfall data from the rain gauges that have been installed by the Authority in each ward. On the other hand, Longido District Council, through its Departments of Agriculture and Livestock Development, has three rain gauges for collecting rainfall data. It was, however, noted that there is no coordination between TMA and the District Councils for collecting and sharing weather data. For example, daily rainfall data collected by both Kiteto and Longido Districts are not sent to TMA.

At the district and local levels, production of climate information is done by district councils through the Departments of Agriculture and Water for Kiteto District and the Department of Livestock for Longido District. In Kiteto District Council, the Department of Agriculture at the district level generates weather data (rainfall, wind) for agricultural decision making pertaining to advisories to farmers related to the timing of planting, cultivation, and harvesting of crops. Wind data is used to forecast armyworms in that particular year. Similarly, the Department of Water at district level generates rainfall data for water resources use and management for the District. The data generated is used by the RBA offices for water resources management in the respective basin. Likewise, the Planning Department at the district level uses the rainfall information for planning purposes at the district level. In Longido District, the Department of Livestock generates rainfall data, which are used by extension officers to advise pastoralists on pasture availability and management, particularly during dry spells, and to provide advice on the best time to move livestock to places with better pasture and water availability.

Extension data (i.e. translated/interpreted projections of rainfall data) is also used to advise livestock keepers on the techniques for reserving grazing areas during the wet season that can then be used during the dry reason.

In addition to generation of scientific data and forecasts, results from the key informant interviews and FGD conducted in both districts (Kiteto and Longido) confirmed that local communities generate their own weather forecasts based on local and indigenous knowledge (IK) connected to observing local environmental indicators and variables, but that there are no systematic institutional pathways for delivering this information to users at local, district, or national levels. For example, respondents in Ilera village (Kiteto District) explained that when Acacia tree species produce flowers and fruits, it is an indication of the onset of rainfall within the coming month. Some elders have their own way of checking the wind movements, direction, and circulation and rely on these observations to estimate the onset of the rains. Likewise, respondents in Kimokouwa village (Longido District) stated that when a slaughtered goat's appendix is observed to contain some amount of water, it is an indication of rain onset. Changes in animal and human behaviors (changes in human body conditions, such as development of illness, and increased animal laziness) may also be considered to be indications of imminent rain onset. Communities also predict the onset of rainfall using astronomical observations. An oblique orientation of the moon was described as an indication that it will rain. Conversely, when the moon is oriented in a horizontal direction, this indicates that it will not rain.

However, while indigenous forecasts are considered valuable, they are not distributed systematically. For example, in Longido District, respondents indicated that not all community members are able to produce climate and meteorological predictions themselves, even if nearly all community members are aware of and use indigenous forecasts; rather, select individuals are considered to be experts on this subject.⁷ Linkages between these local experts and other community members generally occur through informal institutions and interactions (e.g., customary meetings, day-to-day interactions). For example, indigenous forecasts are sometimes discussed during meetings called by the village government or traditional leadership, but often not in a systematic or regular fashion. Much of the time, receiving news of indigenous forecasts depends on encounters through day-to-day activities with family, friends, or neighbors or chance meetings or encounters, through which information about the forecast can be shared. Additionally, some community members access indigenous forecasts by actively seeking out indigenous forecasters to request their advice.⁸

⁷ Daly, M. (2014). *Climate Knowledge Production, Access, and Use for Climate Adaptation in Northern Tanzania*. Presentation at the Annual Meeting of the Association of American Geographers, Tampa, Florida, 13 April 2014.

⁸ Ibid.

4.2 Main users and applications of climate and meteorological information

The climate information that is produced by TMA and other institutions is used for a variety of purposes. At the national level the main users of climate information include: the Ministry of Transport; Tanzania Civil Aviation Authority; Tanzania Ports Authority; Tanzania Airports Authority; Ministry of Health and Social Welfare; Ministry of Works; Tanzania People's Defense Forces; Tanzania Marine Parks Authority; Tanzania National Roads Development; Surface and Marine Transport Regulatory Authority; and academic and research institutions. This is in addition to the MoW, MLFD, MAFC, MLHHSD, PMO-DMD, and RBAs, which are also users of information coming from TMA. A summary of the main uses of climate and meteorological information by select institutions is presented in Table 1 below.

No.	Institution	Main uses of climate/meteorological information
1	Ministry of Agriculture, Food Security and Cooperatives (MAFC)	<ul style="list-style-type: none"> • Monitoring crop production trends based on seasonal and monthly rainfall and humidity forecasts. • Monitoring and predicting crop situation at farm level based on predicted soil moisture levels • Predicting and monitoring crop pest and disease outbreak patterns based on predicted rainfall and wind direction and speed. • Providing advisory services to farmers with regard to which crops and varieties to plant based on anticipated rainfall (such as early maturing and drought resistant varieties), and on the appropriate type and timing of fertilizer application • Provision of extension services to farmers for adopting irrigated farming as way to cope with climate variability and change • Planning short-term measures to deal with hostile weather conditions (drought or excessive rains/floods), such as choice of crop varieties and relevant agricultural inputs like seeds and pesticides; soil erosion control measures against run-off, e.g., terraces • Seasonal forecasts produced by TMA help to predict crop production at the District level, and alongside monitoring of crop prices can be used to determine how climate variability will affect domestic food prices. • Identifying and mapping vulnerable areas to weather extremes (dry and wet areas) based on seasonal forecasts and weather outlooks for seasonal rainfall patterns (<i>Vuli</i> and <i>Masika</i> rains⁹) in the country • Planning for sufficient national food stocks and counteracting food deficits based on anticipated crop production with regard to predicted rainfall performance.
2	Ministry of Health and Social Welfare (MoHSW)	<ul style="list-style-type: none"> • Emergency response preparedness plans in terms of medicine requirements should climatic conditions lead to outbreak of disease epidemics such as Pneumonia and water-borne diseases during floods and droughts based on seasonal forecasts and early warnings issued by TMA. • Malnutrition control during droughts (e.g. dealing with Kwashiorkor¹⁰) based on own vulnerability assessments that draw on TMA weather outlooks of the year and national food situation predictions produced by MAFC • Vulnerability and risk mapping for public health exposure to climate variability and change based on seasonal weather forecasts • To define, locate and reach particularly vulnerable and at risk populations during a climate-related emergency based on early warnings of predicted climate/weather extremes such as floods.

⁹ *Vuli rains* refer to short rains in the northern and coastal areas of the country mainly October-November-December (OND). *Masika rains* refers to long rainfall season mainly March-April-May (MAM).

¹⁰ Kwashiorkor is a severe form of protein deficiency.

3	Prime Minister's Office Disaster Risk Reduction and Management (PMO-DMD)	<ul style="list-style-type: none"> Based on early warnings issued by TMA, PMO-DMD undertake the following: Disaster risk management planning Emergency response, coordinate disaster preparedness efforts and activities Organization and delivery of emergency food, seed, shelter, medical and other aid to the victims of weather extremes.
4	Ministry of Livestock and Fisheries Development (MLFD)	<ul style="list-style-type: none"> Establishment of livestock early warnings based on TMA seasonal weather forecasts. Prediction of livestock movements based on anticipated pasture quality given the projections for seasonal rainfall distribution Determination of the likelihood of livestock disease outbreaks and drought based on early warnings of weather extremes and seasonal weather outlooks generated by TMA Advising pastoralists on the appropriate time for destocking/selling of animals to obtain a better price with regard to predicted seasonal rainfall performance and distribution Remotely- sensed climatic information generated by MLFD together with TMA weather forecast is used to facilitate predictions of wet places where animals may pasture.

Table 1: Summary of the main public users and applications of climate/meteorological information at the national level

The main users of climate and meteorological information at the sub-national level include the District Departments of Agriculture, Livestock, Beekeeping, Water, Planning and Finance, Natural Resources and Environment, Land, and Public Health. Table 2, below, describes how various sectors/departments at the district level apply climate and meteorological information in sector-related planning and decision-making.

No.	Sector/ Department	Main Uses of Climate/Meteorological Information at District Level	
		Short-term planning related to use of climate information	Long-term planning related to uses of climate information
1	Agriculture	<ul style="list-style-type: none"> i. Provision of advisories to farmers in relation to agricultural activities such as: <ul style="list-style-type: none"> a) Farm preparation at household level b) Type of crops that are drought resistant c) Timing of fertilizer application depending on soil moisture and rainfall availability d) Timing of planting in relation to rainfall e) Timing on use of pesticides and responding to pests such as Army Worms f) Planting and harvesting times to avoid wild animal invasion on farm lands and destruction of crops 	<ul style="list-style-type: none"> i. Conducting research to develop new crop and seed varieties and other adaptation strategies to deal with rainfall variability that would suit agricultural needs of the district based on past and current trend of climate /weather outlooks especially rainfall performance

		g)	Food budgeting depending on the forecasted rainfall at district level		
2	Water	i.	The water department at Kiteto district performs site identification and designs water dams based on predicted underground water recharge and discharge with regard to rainfall performance and temperature trends at the district level.	i.	Timing of geological surveys to identify suitable locations for drilling wells
		ii.	The seasonal weather forecast is used to guide water resources allocation and utilization at the basin level.	ii.	Rainfall data generated by both, the Ministry of Water and TMA helps in planning water resources management at the district and water basin levels.
		iii.	Water harvesting and storage practices are recommended to households based on forecasted rainfall amount.	iii.	The Longido District Council in collaboration with donors is using long-term climate scenarios to develop water projects that drain water from nearby rivers and store it in dams that are to be constructed within the district. ¹¹
3	Land, Natural resources and Environment	i.	Timing of conservation activities such as dates of planting trees, and short-term soil erosion control practices such as terraces based on expected rainfall.	i.	Land-use planning based on long-term climate scenarios issued by TMA
4	Planning and Finance	i.	Budgeting for responding to climate-related disasters based on weather outlooks of the previous year issued by TMA for Kiteto district council, while Longido district partly depends on weather forecasts aired by Kenya Meteorological Department (KMD). ¹²	i.	Preparing long term district strategic plans (five years and/ or more) to overcome district challenges including climate related, drawing on long term climate scenarios issued by TMA
		ii.	Making annual projections about the rise or fall of agricultural production and therefore planning how to respond should deficits		

¹¹ Information is based on key informant interviews in Longido District.

¹² According to both key informants and FGD with villagers, since Longido borders Kenya in the Northern part of the country, the weather forecast issued by KMD for the southwestern part of Kenya is more accurate in Longido than the one issued by TMA. Radio frequencies from Kenya are also more easily accessible in Longido compared to those in Tanzania. Therefore, many people use weather information issued by KMD.

			<p>arise based on predicted rainfall amount.</p> <p>iii. Projection of district revenue and budget depending on expected performance of livestock and farming activities given the projected rainfall forecasted by TMA or KMD for Longido district.</p>	
5	Livestock	<p>ii. Using the seasonal rainfall forecast issued by TMA and own-generated rainfall data, the district livestock department predicts pasture availability and advises pastoralists on appropriate actions to take.</p> <p>iii. Based on TMA rainfall projections and their own generated rainfall data (and considering the indigenous weather forecast issued by local communities at Longido district) the department provides advisory services to pastoralists on:</p> <p>iv. destocking,</p> <p>v. timing of animal migration</p> <p>vi. timing of selling livestock in relation to prices</p> <p>vii. timing responses to livestock epidemics and disease outbreaks such as Rift Valley Fever</p> <p>viii. Budgeting/allocating pasture land for grazing during drought spells and rainy seasons.</p>	<p>i. Using the long-term climate scenarios issued by TMA, the district councils plan activities that anticipate and respond to projected climate change impacts, such as soil and water conservation activities</p>	
6	Public Health	<p>ii. Planning for sanitation control in the event of flooding</p> <p>iii. Preparing medical assistance in the event of climate/weather related disasters, based on early warnings generated by TMA through the PMO-DMD.</p>	<p>i. Predicting patterns of disease such as Malaria based on temperature trends and rainfall forecasts issued by TMA.</p> <p>ii. Preparing to respond to epidemic outbreaks with support from the Ministry of Health, and Social Welfare</p>	

Table 2. Summary of the main public users and applications of climate/meteorological information in Longido and Kiteto Districts

The responses from FGD with local communities in Kimokouwa and Ilera villages revealed that farmers and livestock keepers are the main users of climate and meteorological information at the grassroots level. This is because farming and livestock keeping are the main livelihood activities in the rural areas of these districts. For example, in Longido District about 95% of communities are engaged in livestock keeping, while only about 5% practice farming as their predominant livelihood strategy.¹³ For Kiteto district, the situation is somewhat different, with greater livelihood diversity. The predominant livelihoods for populations in Kiteto are: pastoralism (60%), agriculture (22.8%), and agro-pastoralism (17.2%).¹⁴

Farmers and livestock keepers use seasonal rainfall forecasts to make decisions in their day-to-day livelihood activities, for example in deciding when to begin farm preparation, plant crops, or shift livestock to new pastures. However, as noted in subsequent sections, problems of accessing and interpreting the weather and seasonal climate forecasts delivered via mass media result in reliance on local and indigenous knowledge of forecasting the weather at local scales.

4.3 Transmission, translation, and delivery of climate information

The current flow of the climate information that is generated by TMA is via two main streams. The first stream involves communicating information to the public through: mass media (mainly radios, television, and newspapers), TMA websites, and mobile phones (for time-sensitive information of up to five days lead time). The second stream involves delivering information to government institutions through posted letters (weather briefs), e-mail, fax, telephone, and face-to-face delivery. TMA also receives information and queries as feedback from the general public and government institutions through telephone calls, emails, and fax, and responds to them accordingly. Figure 1 illustrates the existing communication/translation framework for the climate and meteorological information provided by TMA.

¹³ URT (2012). National Population and Housing Census Report. Dar es Salaam.

¹⁴ KINNAPA (2011), A profile of KINNAPA development programme, Kiteto District, Manyara Region, Tanzania

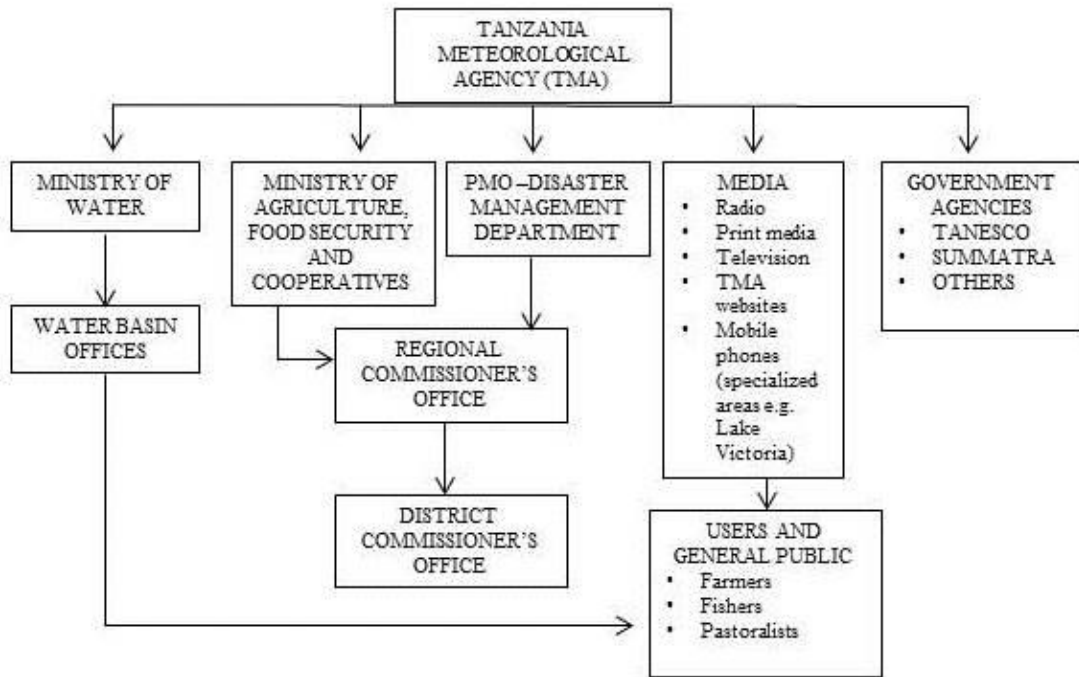


Figure 1: Existing flow of climate and weather forecast information in Tanzania
 Source: Authors (2014)

The climate information that TMA provides is translated by users (who are in turn also providers of climate services) at the national and district levels in various ways. For example, agricultural weather forecasts are distributed by TMA to the Regional Secretariats, where they are re-analysed by agricultural departments to suit the needs of the farmers of a particular region. From the Regional level, the re-analysed information is then distributed to the District Councils through their Departments of Agriculture via post. After receiving the information, the District Council, through the Department of Agriculture, further analyses the information to suit the needs of a respective district. The information is then distributed to farmers and pastoralists through advisory services provided by agricultural extension officers.

4.4 Respondent views on the timeliness, salience, and credibility of climate information

Although the climate and meteorological information that TMA generate are communicated widely through a range of channels, interviews with key informants and FGD participants at national, district, and local village levels revealed that there are a number of challenges associated with the existing information communication system. TMA's information communication to government institutions at the national and district levels is often hampered by delays of up to one month due to bureaucratic processes, which impede the timely flow of information. For

example, information from TMA that is delivered to government institutions is first channeled through the Prime Minister's office for further distribution to the Ministries and Regional Offices. From the Regional Office, information is then channeled to the District Councils. It was reported during FGD sessions that such information rarely reaches grassroots end-users, such as farmers and livestock keepers. Respondents also reported that when the information does arrive, it takes a long time to reach the designated destination. There are also cases when the information has been misdirected. For example, respondents noted that in some cases Kiteto District Council has received information for Simanjiro District while information for Kiteto was misdirected to Simanjiro. Informants also highlighted that the language used to communicate this information is too technical for users without technical specialization in meteorology or climate-related disciplines to understand. For example, a recent climate outlook for Tanzania (October – December, 2014 rainfall season) illustrates the technical language, an excerpt of which reads:

“The rains are expected to be normal to above normal over the northern coast (Dar es Salaam, Northern Morogoro, Coast regions, including Unguja and Pemba isles), Northeastern Highlands (Kilimanjaro, Arusha and Manyara regions) and Lake Victoria Basin (Kagera, Geita, Mara, Mwanza, Simiyu, and Shinyanga)”.¹⁵

For the general public and other average users of climate information, it is difficult to understand and interpret what “normal to above normal” rain conditions would imply for localized actions without having an in depth understanding of the climatology of the region.

Responses from FGD in Kimokouwa and Ilera villages suggest that the daily, monthly, and seasonal weather forecast that reaches farmers and pastoralists through radios and television (i.e. the mass media) is too general and that the language used is difficult to understand. Stakeholders further claimed that this information is, in most cases, vague and generalized, rather than being specific to a particular geographical area. Moreover, the information is not tailored to suit the needs of diverse end-users in a given area. As a result, participants in FGD in Kimokouwa and Ilera villages pointed out that the seasonal forecasts that are generated by TMA are not widely used by people because they are difficult to interpret by local communities. Similar views were presented by key informants at Kiteto and Longido District Councils, as well as stakeholders consulted in sector ministries such as the MLFD, MoHSW, and MAFC. For example, Kiteto District Agricultural, Irrigation, and Cooperative officers stated that the seasonal and monthly forecasts that are provided by TMA are presented in a language that agricultural officers cannot understand; yet, these officers are expected to translate the forecast into simple, understandable, and applicable information for their farmers. Informants further

¹⁵ TMA, Seasonal Forecast, Press Release Climate Outlook For Tanzania October – December, 2014 Rainfall Season. <http://www.meteo.go.tz/wfo/seasonal.php>. retrieved December 5, 2014

explained that despite the technical language used in disseminating climate information, the forecasts do not specify the exact timing of rainfall, nor do they specify with sufficient detail the areas that can be expected to receive rains. Such opinions were also shared by non-state actors such as KINNAPA¹⁶ and NAADUTARO¹⁷, both based in Kiteto District. TMA confirmed the views that were expressed by stakeholders in the study. Given the limitations that emanate from climate and meteorological information delivery, translation, and application, local communities in Longido and Kiteto rely on indigenous weather forecasting methods for decision-making, which was reported to be easier to apply as compared to TMA climate/meteorological information. The importance of IK was also recognized by respondents at TMA and other institutions in the country. It is on these grounds that TMA has embarked on further research to establish how IK complements the scientific forecasting system.

4.5 Limitations and challenges facing climate information providers

Technical and financial limitations

A number of limitations related to financial and human resources and technical and institutional challenges were advanced by TMA to explain current bottlenecks in the communication and translation of climate and meteorological information to end-users. Technical limitations include a limited number of operational weather stations, and a lack of enhanced surface and upper air observations for comprehensive monitoring of climate and meteorological variables in the country. There are also financial limitations associated with the high cost involved in running weather stations in the country. Table 3 provides an overview of the current and needed equipment inventory, identified by the Ministry of Transport as part of the meteorological sub-sector review, to enhance TMA's climate monitoring capacity.

¹⁶ KINNAPA Development Programme is a Community Based non-profit making organization based in the district of Kiteto. The name KINNAPA is an abbreviation of the names of those founding six villages, which are Kibaya, Kimana, Njoro, Ndaleta, Namelock and Partimbo.

¹⁷ NAADUTARO is an NGO located in Kiteto district with a vision to help pastoral societies with the survival options on secured land and environment. The name NAADUTARO is a Maasai name which means *Pastoralists' Survival Options*.

No.	Description of equipment / stations	Number of Stations			
		Current	Operational	Needed	Shortage
1	Conventional surface synoptic stations	29	29	32	3
2	AWS surface synoptic stations	25	13	113	88
3	Agro meteorological stations	15	15	20	5
4	Ordinary climate stations	150	60	250	100
5	Rainfall stations	2056	500	500	0
6	Automatic rainfall stations	0	0	2500	2500
7	Marine weather stations	0	0	12	12
9	Upper air stations	1	1	4	3
10	Pilot balloon	1	0	5	5
11	Weather radar	2	1	7	5
12	Lighting	0	0	10	10
13	Orbiting satellite receiver	0	0	1	1

Table 3: Inventory of current and needed equipment to enhance TMA’s climate monitoring capacity, as of October 2014¹⁸

Institutional limitations

A second limitation that prevents the development of salient, credible, and legitimate climate services has to do with TMA’s legal mandate and its positioning within the national institutional architecture. All technical matters related to monitoring of climate and weather are handled by TMA, which is also the designated national focal point for the Intergovernmental Panel on Climate Change (IPCC). Although TMA plays a central role in the production and communication of climate and meteorological information at the national level, communication between TMA and relevant institutions and decision-making bodies at the national, district, and grassroots levels is hampered by bureaucratic processes and the lack of mandate to create and sustain the necessary institutional mechanisms to facilitate interaction between producers and users of climate services. The VPO-DoE and the PMO-DMD also have key institutional roles in delivering climate information at the national level; however, their roles and responsibilities are quite different. The VPO is primarily responsible for climate change mitigation and

¹⁸ URT (2014) *Ministry of Transport – Meteorological Sub-sector Performance Review Paper for the Eighth Joint Transport Sector Review Meeting (JSTR)*. Dar es Salaam October 2014.

adaptation policy and legal frameworks and is the national focal point for the United Nations Framework Convention on Climate Change (UNFCCC) and the designated national authority on climate change issues. The VPO is primarily responsible for long-term climate change adaptation planning and implementation. The PMO-DMD deals with operational aspects of climate/weather extremes like floods and droughts, which generally occur on shorter time-horizons (e.g. weeks to months). The relationships between these institutions are illustrated in Figure 2, below. All other sector ministries, non-state agencies and the private sector are linked to the PMO-DMD on matters pertaining to disaster risk reduction and management (DRR/DM), VPO-DoE on climate change and environmental policy matters, and TMA on matters pertaining to the production of climate/meteorological information. This division is intended to smooth the flow of information and provide a clear separation of mandates both horizontally and vertically across the governance structure. However, in practice, this division of responsibilities and current institutional arrangements may limit interaction between these three key institutions and may result in the lack of integration between short- and long-term climate adaptation planning and implementation.

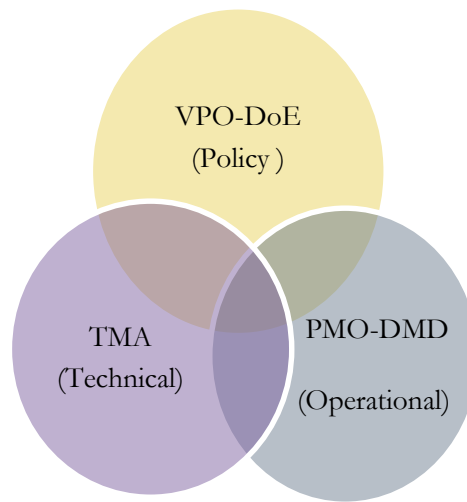


Figure 2: Institutional Relationships governing generation, provision and application of climate and meteorological information in Tanzania Source: Authors (2014)

The roles and mandates described above provide several avenues for information sharing between these institutions, however this occurs primarily through formal board meetings that bring together members from a range of institutions, including TMA and other ministries, departments, and agencies. However, beyond board meetings, there is not an established or continuous means of facilitating information flows between these institutional spheres, which may result in disconnects between policy, technical, and operational matters and limited flows of information horizontally across national level institutions. While the VPO and PMO can direct other sector ministries and non-state agencies to act on climate information, TMA forecasts, early warnings, and advisories, which can either be taken seriously or ignored by the agencies that are responsible for implementation. TMA must channel climate and weather forecasts and warnings to the PMO-DMD for further downward communication and enforcement within relevant sector ministries, to the regional and district levels, and to non-state actors. Unfortunately, according to key informant interviews, the PMO-DMD is understaffed and resource-constrained. This may cause delays in information delivery and slow responses to disaster events such as floods, droughts, and storms.

Additionally, the current positioning of TMA within the national planning architecture limits the potential for collaboration with other national and district-level institutions that have a stake in the generation, development and provision of climate information and services (Tables 1 and 2). For example, the MoW generates weather data that are not shared with other institutions such as TMA. Moreover, TMA has no formal institutional link with Regional and District-level institutions. This disconnect has made it difficult for end-users such as farmers and pastoralists to access climate and meteorological information services which are critical for their livelihoods. It is also important to note that there are currently no formal institutional channels or forums that would enable end-users at local levels and providers of climate information and services to

interact regularly. This prevents end-users, whether at the grassroots or the national level, from providing feedback on the climate information that TMA provides and inhibits open communication with TMA about the types of climate information or services that users need or would like to see developed. Furthermore, TMA was originally placed under the Ministry of Transport to facilitate the needs of the aviation and shipping industries, which were the primary users of meteorological services at the time. Currently, however, the number of actual and potential users of climate and meteorological information has expanded far beyond the transport sector (see Tables 1 and 2). Thus, there is a need to examine options for improving TMA's linkages with other national institutions, in order to create increased opportunities for dialogue and feedback between TMA and a wide range of national level partners that will be needed to enhance the usability of climate services in Tanzania across institutional scales.

As part of this effort, the Tanzania Disaster Management Committee (TANDREC) expanded its mandate in August 2014 to act as the Steering Committee for the implementation of the GFCS Adaptation Programme in Africa. TANDREC is an inter-ministerial committee that reports to the Prime Minister and is composed of the Principal Secretary in the PMO and eight other members, who are Ministers in relevant sectors and are appointed by the Prime Minister.¹⁹ Given the multi-sectorial nature of the committee, placing oversight of the national climate services framework under TANDREC presents a significant opportunity to enable cross-sectorial dialogue and interaction between TMA and other national level institutions. Currently, however, TANDREC is only mandated to meet on an "as-needed" basis, often in response to disasters. Therefore, it will be important to ensure that TANDREC will have sufficient capacities and supporting resources to enable it to meet regularly and to effectively facilitate the User Interface Platform components of the GFCS Adaptation Programme in Tanzania, in addition to its primary responsibility of overseeing national disaster management issues. This will likely require additional human and financial resources that are dedicated specifically to managing use/producer interfaces in order to ensure continuity and sustainability. Additionally, because TANDREC is situated under the PMO, which is focused primarily on the operational aspects of climate information use for disaster management activities (see Figure 2), efforts should be made to ensure that climate services development is also well linked with policy dimensions and other long-term climate change mitigation and adaptation activities, which are overseen primarily by the VPO (see Figure 2). It is expected that national disaster policies and legislation will be updated in the near future, which may provide mandates for more regular meetings of TANDREC. The PMO is also in the process of upgrading the DMD to acquire semi-autonomous agency status. This move aims to address the challenges that the DMD is faced with, including: a shortage of specialized staff, limited financial resources, limited powers and mandates, and difficulty accessing and delivering services (i.e., disaster preparedness, awareness, and response). It is expected that such challenges would be overcome and that the agency would have wider coverage, with District-level offices, if the department were to transition to a semi-autonomous agency. This could represent a significant opportunity for

¹⁹ United Republic of Tanzania (1990) *Disaster Relief Coordination Act*.

facilitating more direct linkages between national and sub-national institutions, which could overcome current bottlenecks to facilitate more efficient delivery of climate information in the future.

4.6 Mainstreaming climate variability and change into national sectorial and district policies and plans

Despite the fact that climate change is expected to have far-reaching impacts on Tanzanian society and the economy, the findings discussed in sections 4.1 and 4.2 (and summaries in tables 2 and 3), indicate that the main uses of meteorological and climate information by end-users at the national and District levels relate to short-term (seasonal to annual) applications as opposed to longer-term planning and decision-making. The VPO-DoE has overall responsibility for climate change policy in Tanzania. However, observations from this and other studies²⁰ indicate that the capacity of Tanzania's public institutions to respond to the long-term challenges of climate change by actively integrating and mainstreaming these concerns into public policies connected to agriculture, health, and DRR is still low. This is partly due to limited knowledge and financial and human resources to address climate change among sector ministries. The study conducted by Yanda and Bird revealed that climate change issues are not yet embedded in most of the government institutional plans and programs at either national or sub-national (district) levels. A good example is the National Development Vision 2025, which does not acknowledge climate change as a threat to achieving the desired goals. However, there are some plans that have been established to deal specifically with climate change issues, such as the Tanzania Agriculture Climate Resilience Plan. At the district level, climate change is addressed indirectly as an environmental issue. For Longido district in particular, which has been severely hit by droughts for many years, most of its development plans are geared towards addressing drought-related challenges such as water shortages. However, both the short- and long-term climate change planning that is currently taking place in various government institutions are geared towards fulfillment of institutional and legal mandates without a full realization of the significance of climate change challenges for planning purposes.

4.7 Personnel and budgetary resources for addressing climate change

The fact that climate change issues are yet to be mainstreamed in official policies or recognized as requiring a formal institutional role in most of the institutions visited, means that there is an absence of climate change financing windows in most of the public institutions in Tanzania.

²⁰ See, for example, Bird and Yanda (2014). Climate Finance in Tanzania: What is the Record in the National Budget? University of Dar es Salaam, Tanzania.

For example, an interview with the VPO-DoE office revealed that climate change expenditures in various ministries and government agencies are currently covered through other financing windows on an *ad hoc* basis. Most of the climate change-related activities, including responses to climate extremes, are externally financed through various donors and non-government organizations. For example, in Longido district a recent initiative called ‘Promoting Adaptation and Climate Resilience Growth Through Devolved District Climate Finance’, has just concluded its pilot phase and is seeking funds to continue project activities (as of April 2015). This project enhanced district-level capacities through trainings in multiple areas (e.g., participatory mapping, vulnerability analysis, financial oversight) and developed mechanisms to direct climate adaptation funding directly to district level authorities to facilitate more flexibility in responding to local level climate impacts. However, the project was implemented by the International Institute for Environment and Development (IIED) and funded by the UK government through its Department for International Development, with small financial contributions coming from the Districts themselves. Thus, a major challenge with this type of funding is that it is project-based and does not represent a sustainable funding stream to maintain climate adaptation activities over the long-term.

With respect to human resources, participant responses in this and other studies show that most of the government ministries and agencies do not have specific departments or sections that deal specifically with climate change. Although some ministries have established desks for mainstreaming climate change within their respective sectors, the current capacity of these desks is restricted by limited knowledge on climate change.²¹ For example, the MAFC has climate change section, but its capacity is constrained by a small number of staff and lack of relevant specialists. On the other hand, the MoHSW does not have a desk or any specialized personnel dedicated to climate change issues. Instead, it addresses climate related matters through the Disaster Management, Emergency Preparedness and Response Section under the Department of Health Quality Assurance.

Currently, there are no government service positions at the district level that are specific to climate change issues (e.g. District Climate Change Officer). This prevents recruitment and employment of climate change specialists within district offices, which in turn limits the capacity of District Councils to respond to and plan for climate variability and change, including climate extremes, effectively without the support of non-governmental organizations (NGOs). For example, Longido District Council has a number of climate related projects and initiatives, but in the absence of a dedicated climate change specialist in the District, the District Economic Officer currently serves as the Climate Change Focal Point.

²¹ Bird and Yanda, (2014). *Climate finance in Tanzania: what is the record in the national budget?* University of Dar es Salaam, Tanzania.

4.8 International Influence on climate adaptation and mitigation efforts

Tanzania is a signatory to various multilateral environment and climate-related agreements such as the UNFCCC and the (now expired) Kyoto Protocol at the international level, and regional agreements reached through regional economic cooperation bodies such as the East African Community (EAC), the Southern Africa Development Community (SADC), and the African Union (AU).

There are current mismatches between the expectations of the international donor community under international agreements and the current government capacities. The Government of Tanzania has various obligations with respect to implementing international agreements, but some of these obligations require greater financial and human resources capacity than the government currently has. This leads to pressure from the international community for the government to improve its performance. Key informants at VPO-DoE clarified that such pressure from the international donor community pushes the Government of Tanzania to do more than is required under the UNFCCC Convention Article 4 (commitments). For example, this has resulted in pressure to adopt climate smart agriculture or green economy policies that are not compatible with the country's current level of development. On the other hand, it was also noted that the Government of Tanzania experiences pressure from the international donor community when it fails to deliver expected outcomes due to a number of constraints, including financial limitations, which affect its ability to effectively prepare for and respond to climate variability and change.

4.9 Non-state climate change initiatives in Longido and Kiteto Districts

There are currently a number of joint efforts between the government and non-state actors in Longido and Kiteto Districts. Such initiatives are often facilitated by local NGOs. Two of these NGOs were visited in Kiteto district: KINNAPA and NAADUTARO.

KINNAPA was officially registered in 1992 with the main objective of addressing the land-use conflicts that abounded in the districts at the time. However over time, the scope of its activities has expanded to include emerging issues such as climate change. Currently, KINNAPA is also involved in a range of livestock and agricultural development initiatives as well as initiatives focused on gender, women and children affairs; water hygiene and sanitation; education and training; and environment and natural resources management. KINNAPA's activities and programs are implemented in collaboration with the Kiteto District Council. The climate change-related activities undertaken by KINNAPA include trainings on climate change adaptation issues in agriculture, livestock keeping, water (rain water harvesting) and community health to more than fifteen villages, land use planning and zoning for environmental protection (9 villages have established village land use plans), establishment of tree nurseries, establishing joint livestock grazing areas and pastures during dry seasons in three villages, and trainings on environmental conservation. KINNAPA is also implementing a project called "Mwanzo Bora" (*Better Beginning*) in three districts of Kiteto, Simanjiro, and Babati. This project is implemented jointly between the Governments of the United Republic of Tanzania and United States of America and focuses on improving food security and nutrition for women and children. Activities covered by under the project include growing vegetables, installing and running

milling machines, provision of loans to encourage investment in small businesses, and provision of child care in collaboration with Kiteto District Council.

NAADUTARO is an NGO located in Kiteto District. It was established in 2013, and its vision is to ensure that agro-pastoralist societies can thrive through secure access to land and environmental resources. The organisation has recently completed implementation of a project to enhance public education and awareness on climate change issues and adaptation strategies related to agriculture, water, community health and livestock keeping. This included training a small team of facilitators who provided education about climate change community-level. NAADUTARO activities cover nine villages, all of which are located in Kiteto District. It works in collaboration with both national and international stakeholders including the VPO-DoE, NEMC, TMA, Japanese International Cooperation Agency (JICA), CARE International, Forum CC, and Kiteto District Council.

5 Conclusion

This analysis has examined the institutional landscape for climate services delivery in Tanzania. This has enabled a comprehensive understanding of current climate information flows, as well as the institutions that are involved. The analysis shows that TMA is the primary producer of climate and meteorological information in Tanzania. There are also several other government institutions that produce limited climate and meteorological data and information, particularly at the district and river basin levels, though the information produced by these institutions is not well linked with TMA. Climate and meteorological information that is produced by TMA is delivered primarily via two pathways: via the mass media and through formal governmental structures, including ministries, departments, and agencies. However, avenues for users of climate services to provide feedback to TMA are limited, meaning that information and knowledge flows have remained primarily unidirectional. Nonetheless, the analysis has highlighted that there are already a wide range of users of climate information from the national to sub-national level, but the extent to which such information is used varies considerably across sectors and among particular users. For example, the water and food security sectors exhibit a higher level of climate information use. Respondents at the local level indicate that there is lack of credibility, salience, and legitimacy of scientific climate and meteorological information, which prevents use of scientific climate and meteorological information. As such, IK is an important source of climate and meteorological information, but this knowledge is currently not formally integrated within existing institutions that deal with climate service provision.

In describing and assessing the institutional landscape for climate information production, communication and application in Tanzania, this study has identified a number of specific

challenges that affect the ability of producers and users to engage in and benefit from the development of climate services:

1. A need for enhanced linkages and the development of modalities for cooperation among key national level institutions in order to leverage and strengthen existing capacities and to facilitate interaction between producers/users of climate services. It will be important to strengthen linkages between TMA and other key national institutions responsible for the policy (e.g., VPO-DoE) and operational dimensions (e.g., DMD-PMO) of climate change and climate services to enhance coordination and cooperation across technical, policy, and operational spheres. TANDREC, in its new role as Steering Committee for the GFCS Adaptation Programme in Africa, has been tasked with facilitating interfaces between producers and users of information, but may currently lack appropriate legal mandates, as well as supporting mechanisms and resources, to ensure regular and sustainable opportunities for interaction necessary to support co-production of climate services.
2. Technical, financial, and human resource limitations may inhibit effective climate services provision and use. There is a clear need for increased financial investments to support the purchase and maintenance of technical instruments to enable sufficient monitoring and prediction of weather and climate in Tanzania (see Table 3). This is compounded by insufficient human resource capacities in key government agencies that are tasked with transmitting climate and meteorological information. In particular, human resource limitations in the PMO, which is a key gatekeeper for climate information delivery at the national level, may create bottlenecks that significantly delay the transmission of this information to other ministries, departments, and agencies at the national level and to regional and district government offices.
3. Lack of sufficient mechanisms to facilitate systematic flows of information between government agencies, both vertically and horizontally, may prevent effective climate services provision and use. Effective delivery of climate and meteorological information in Tanzania is currently hampered by bureaucratic protocols. The information that TMA produces must often pass through multiple institutional layers before it can reach intended users. Additionally, while there is a clear division of responsibilities between the PMO and the VPO with regard to the operational and policy aspects of climate change, this can create barriers to effective flows of information. Stemming from this division, the PMO generally tends to deal primarily with short-term climate information, while the VPO tends to deal primarily with long-term climate information. This institutional arrangement may limit effective integration of short- and long-term climate adaptation strategies. In addition to TMA, there are other institutions (e.g., river basin authorities, district councils) that produce a range of climate and meteorological data and information, but there are no mechanisms to systematically share these with TMA or other relevant institutions.
4. Limited specialized knowledge and expertise and dedicated governmental structures may limit capacities for effective use of climate services within adaptation planning across sectors, at national and sub-national levels. Many ministries, agencies, and departments at the national level do not have staff positions that are dedicated to

climate change issues and, even when they do, these staff members do not always have sufficient climate change expertise. At sub-national levels, the absence of dedicated climate change officers often results in reliance on NGOs to facilitate and implement climate adaptation activities. Additionally, because of limited government structures for climate-specific activities, financing for climate change activities are available on an ad-hoc and short-term basis and are generally sourced through external donor agencies. Pressures and demands attached to these external funds have often produced tensions with national development priorities and conflicts with existing capacities.

Based on these challenges, the following recommendations are made:

1. There is a need to **strengthen sustainable institutional mechanisms** for facilitating interactions between TMA and stakeholders to enable effective co-production of climate services. TANDREC has been designated as the national mechanism to enable such interactions; however, it will be important to ensure that the committee will have the necessary supporting capacities to fulfill this new role, in addition to its existing responsibilities. This will likely require inputs of both financial and human resources that are specifically devoted to managing producer/user interfaces for climate services.
2. There is a need to **conduct further studies** of how to improve the credibility, salience, and legitimacy of climate information for local users. In particular, it will be important to understand whether and how IK and scientific knowledge can be integrated to improve the delivery of usable climate services across scales.
3. There is a need to **improve technical expertise and knowledge** of climate change within government institutions at national and sub-national levels. This may include increased training of government employees, as well as the creation of specific staff positions or divisions tasked with overseeing climate change issues within ministries, departments, and agencies.

APPENDIX I: Main public institutions involved in climate information and service provision

Tanzania Meteorological Agency (TMA)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/meteorological services produced	Sources of information
<ul style="list-style-type: none"> • To provide meteorological services for international air navigation of Tanzania • To organize and administer efficient networks of surface and upper air stations to capture accurate records of weather and climatic conditions of Tanzania • Collect, archive, and disseminate meteorological and related information • Take part in global exchange of meteorological and related data and products for the safety of human kind • Carry out research and training on Meteorology and climatology • Cooperate with related international and local institutions • Provide climate and meteorological services and warnings for the safety of the public of Tanzania • Publish weather and climatological summaries • Collect fees and charges for data, products and services rendered 	<ul style="list-style-type: none"> • Climate information (trends, models, extremes, inter-annual variability, higher order statistics) • Weather forecasts • Early warnings • Advisories 	<ul style="list-style-type: none"> • Own generated data (Weather stations) • Global and regional data (WMO, IPCC, UNFCCC secretariat, EAC) • Satellite data • Community data (Feedbacks on seasonal rainfall performance, and research)

Vice President's Office, Division of Environment (VPO-DoE)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/ meteorological services produced	Sources of information
<ul style="list-style-type: none"> National focal point on climate change matters in the country Designated national Climate Change Authority under the Kyoto Protocol Responsible for overall environmental policy and regulation, formulation, and coordination at national and international level Monitoring and implementation of environmental policy in the country Coordination of environmental conservation, assessment and management 	<ul style="list-style-type: none"> Climate policy briefs national position documents on climate change National strategies and action plans 	<ul style="list-style-type: none"> TMA data PMO- DMD UNFCCC-secretariat IPCC, Academic institutions Research institutes
Prime Minister's Office Disaster management department (PMO-DMD)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/ meteorological services produced	Sources of information
<ul style="list-style-type: none"> Coordination of disaster management activities in Tanzania In charge to coordinate disaster preparedness efforts and activities Ensure timely appropriate and efficient organization and delivery of emergency 	<ul style="list-style-type: none"> Vulnerability assessments 	<ul style="list-style-type: none"> Research institutes TMA data UNFCCC data base
Ministry of Water (MoW) River Basins		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/ meteorological services produced	Sources of information
<ul style="list-style-type: none"> To manage water resources in an integrated and comprehensive manner Water resources management, surface and groundwater resources assessment and exploration, Water Resources Planning and Research, Regulatory, Enforcement and Environment 	<ul style="list-style-type: none"> Rainfall data Hydrological data 	<ul style="list-style-type: none"> Own generated data (installed automatic and manual weather stations) Hydrological survey
Ministry of Agriculture, Food Security and Cooperatives (MAFC)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/ meteorological services produced	Sources of information
<ul style="list-style-type: none"> Formulating, coordinating, monitoring and evaluating the implementation of relevant policies in the agricultural sector and monitoring crop regulating institutions, Collaborating with the private sector, local government and other service providers to provide relevant technical services in research, extension, irrigation, plant protection, crop promotion, land use, mechanization, agricultural inputs, information services and cooperative development Undertaking crop monitoring and early warning, maintaining strategic food reserves and promoting appropriate post-harvest technologies Encouraging, undertaking and coordinating research and development and training 	<ul style="list-style-type: none"> Agromet information Agricultural weather advisories Early warnings (state of food production with regard to weather patterns) 	<ul style="list-style-type: none"> Own rain gauges and Agro-meteorological stations TMA Research Community-based information

Ministry of Livestock and Fisheries Development (MLFD)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/meteorological services produced	Sources of information
<ul style="list-style-type: none"> • Coordinate livestock research in the country and outside the country • Upscale appropriate technologies for sustainable livestock productivity • Develop livestock research data base 	<ul style="list-style-type: none"> • Rainfall data • Droughts maps • Monitoring • Humidity briefs • Wind intensity and direction 	<ul style="list-style-type: none"> • Weather stations (at ministry research centers)
Ministry of Lands, Housing and Human Settlements Development (MLHSD)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/meteorological services produced	Sources of information
<ul style="list-style-type: none"> • To prepare policy and strategies for development of land sector • Resolving Land and housing conflicts • Land-use planning 	<ul style="list-style-type: none"> • Marine wave patterns • Coastal wave erosion patterns • Land related Disaster maps (flooding, landslides and earthquakes) 	<ul style="list-style-type: none"> • Tanzania Mapping and survey unit • Tanzania Meteorological Agency • Satellite imagery • VPO • NEMC • Academic institutions (e.g. Ardhi University)
National Environment Management Council (NEMC)		
Institution's formal roles pertaining to climate/meteorological services	Type of climate/meteorological services produced	Sources of information
<ul style="list-style-type: none"> • Identifying, assessing threatened/sensitive/critical/fragile areas/ecosystems and developing management plans in collaboration with other stakeholders, and coordinating environmental issues. 	<ul style="list-style-type: none"> • Prepare policy briefs, publications, journals, brochures 	<ul style="list-style-type: none"> • TMA data base/websites • Research • UNFCCC sources • Community

APPENDIX II: Key informant interview checklist

This key informant checklist aims to assist in collecting information regarding the institutional landscape in Tanzania pertaining to climate services development and delivery. **The major aim is to undertake a thorough assessment of current institutions and institutional processes involved in the supply, communication, and application of climate information for decision-making at the national and district levels in relation to agriculture and food security, health and disaster risk reduction and management. Upon its accomplishment, this study will assist the TMA and collaborating institutions in developing fruitful relations to facilitate the design and functioning of a national climate services system.** The intended experts include but are not limited to the Tanzania Meteorological agency (TMA), National Environment Management Council (NEMC), the Vice President's Office Division of Environment (VPO-DoE), Prime Minister's Office Disaster Management Department (PMO-DMD), Ministry of Agriculture, Food security and Cooperatives (MAFC), Ministry of Health and Social Welfare, Ministry of Water, Ministry of Livestock and Fisheries Development, Ministry of Infrastructure development, Ministry of Energy and Minerals, Ministry of Natural Resources and Tourism, Transport and other related non-state stakeholders.

1. What are the major roles of your institution/department/division regarding:
 - i. Production of climate and meteorological information,
 - ii. Communication of climate and meteorological information
 - iii. Application of climate and meteorological information.
2. Based on the mentioned roles,
 - i. Does your institution /department/division possess the appropriate number of staff with the required expertise/training to fulfill the prescribed roles? Please explain your response.
 - ii. If **NO**, how do you address the problem of staffing?
 - iii. Are the budgetary resources concomitant to fulfill the roles?
 - iv. If **NO**, explain how do you accomplish the prescribed roles given the limited resources?
3. Is your institution/department/division involved:
 - i. Planning and responding to short-term climate extremes (i.e. early warning for floods, emergency preparedness, diseases outbreaks etc.)
 - ii. Planning for long-term climate change i.e. mainstreaming climate change issues into your policies and programmes/strategies. If yes, please explain the current practices that mainstream climate information into planning, policies and decision making process
4. How do you communicate climate and meteorological information to the users? How effective/reliable are the communication pathways that you use?
 - i. What shortfalls/ challenges have you observed in communicating weather forecasts to the users?
 - ii. How do you address the challenges mentioned above?

- iii. What recommendations do you have on how to improve the flow of communication pathways between your institution and the farmers/end users?
- 5. Based on the current practices within your organization to take on board issues of climate change, please explain:
 - i. How your institution/department/division collaborates with other sector/institutions that have a stake in climate change, locally, regionally, nationally and internationally.
 - ii. Who are the partners with complementing, conflicting or overlapping roles? And what are the areas of collaboration?
- 6. What are the collaborating institutions below and above your institution as far as climate/ meteorological information is concerned?
- 7. What is your institution's relationship with those above and below your institution especially regarding:
 - i. Ensuring the availability and application of climate and meteorological information services?
 - ii. Planning for short-term and long term on issues pertaining to agriculture and food security, health (nutrition) and disaster risk reduction and management?
- 8. What influence/pressure, if any, do international institutions and actors exert on your organisation?
- 9. Are you aware of any non-state organization that is involved in climate change issues such as food security, health and disaster risk reduction and management?
 - i. Please explain how the non-state organizations mentioned above use climate information or services in the provision of advisory or other services for example in relation to health issues (including nutrition), agricultural extension services, training services, emergency preparedness etc.?
 - ii. To what extent do these non-state organizations collaborate with public institutions? E.g. at the District Offices?

(Applicable for: TMA, VPO-DoE, PMO-DMD, and MAFC)

- 10. Are you (as a department/agency) aware of the existence of indigenous weather information forecasting?
 - i. What perception do you have on this indigenous science of predicting weather?
 - ii. Is there any correlation that you have established between conventional weather forecasting and the indigenous climate/ weather forecasting to the extent that the two can be merged? Please explain what correlations you have established.
 - iii. What are your opinions on the possibility of cooperating with the indigenous weather forecasters, and how would this be done?

(Applicable for: TMA, VPO-DoE, PMO-DMD, and MAFC)

THANK YOU FOR YOUR CONTINUED COOPERATION

APPENDIX III: Guiding questions for focus group discussions

This focus group discussion aims at involving local communities and particular groups of populations in examining the landscape in Tanzania pertaining to climate services development and delivery. It also aims at assessing the current institutions and institutional process involved in the supply, communication, and application of climate information for decision making at national and local levels. It covers a range of sectors including but not limited to agriculture and food security, community health (including nutrition), livestock keeping and disaster risk reduction and management.

A. Respondents' awareness and perceptions of climate variability and change

- i. What do you understand about climate change/weather variability in your village?
- ii. What are the major indicators of climate change you have observed in the past 30 years?
- iii. What impacts does it have on your agricultural activities and food production?
- iv. What coping mechanisms exist within the village to deal with the impacts?

B. Existing communication flow of climate/meteorological information

- i. Do you always get climate/meteorological information from forecasters?
- ii. Who provides that information?
- iii. How do you receive weather /climate information in your village and/or in which form/ media does this information reach you?
- iv. How understandable and user-friendly is this information/media?
- v. When in the year do you receive weather/ climate information
- vi. What perception do you have on the climate/meteorological information delivered in terms of the timing of information delivery, and applicability and relevance of the information to your needs?
- vii. What is your general perception about the existing weather forecasting communication pathways?
- viii. What obstacles are hindering communication between weather forecasters and users?

C. Recommendations and suggestions for improving communicating of climate and meteorological information.

- i. Which among the communication ways mentioned in A (iii) need to be capitalized on and improved?
- ii. At which time(s) of the year do you need weather forecasts to make informed decisions at the farm level?
- iii. What solutions can you suggest to the communication obstacles between forecasters and users that you mentioned in A (viii)?

THANK YOU FOR YOUR COOPERATION

APPENDIX IV: Roles of Key Informants Interviewed at District Level

1. LONGIDO DISTRICT COUNCIL

NO.	TITLE
1	District Planning Officer
2	District Cooperative Officer
3	Authorized Land Officer
4	District Community Development Officer
5	Land, Natural Resources, and Environment Officer
6	Livestock Officer

2. KITETO DISTRICT COUNCIL

NO.	TITLE
1	District Agriculture, Irrigation and Cooperative Officer
2	Acting District Executive Director
3	District Planning Officer (Agriculture)
4	District Clerk
5	Acting District Water Engineer
6	Computer System Analyst
7	Acting District Environmental Health Officer
8	Acting District Human Resource Officer
9	District Internal Auditor
10	Senior Livestock Officer
11	Acting District Land Officer
12	Technician (Gauge Reader, Volunteer)
13	District Livestock and Fisheries Development Officer
14	District Forest Education Officer
15	District Beekeeping Officer
16	District Community Development Officer

APPENDIX V: Roles of Additional Key Informants Interviewed at National and District Levels

NO.	TITLE
1	Climate Change Desk Officer, VPO-DoE
2	Desk Officer, PMO-DMD
3	Gender Coordinator, Tanzania National Parks (TANAPA)
4	Weather Forecaster, TMA
5	Agricultural Director, National Environmental Management Committee
6	Senior Economist, Longido District Council
7	Chairman of Ilera Village Government, Kiteto District
8	Principal Lands Officer, MLHSD
9	Accountant, NAADUTARO, Kiteto District
10	Principal Livestock Officer, MLDF
11	Principal Researcher, MLDF



CICERO (Center for International Climate and Environmental Research - Oslo)
CICERO (Center for International Climate and Environmental Research - Oslo) was established by the Norwegian government in 1990 as a policy research foundation associated with the University of Oslo. CICERO's research and information helps to keep the Norwegian public informed about developments in climate change and climate policy.

The complexity of climate and environment problems requires global solutions and international cooperation. CICERO's multi-disciplinary research in the areas of the natural sciences, economics and politics is needed to give policy-makers the best possible information on which to base decisions affecting the Earth's climate.

The research at CICERO concentrates on:

- Chemical processes in the atmosphere
- Impacts of climate change on human society and the natural environment caused by emissions of greenhouse gases
- Domestic and international climate policy instruments
- International negotiations on environmental agreements

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