

A GAP ANALYSIS IN CLIMATE SERVICES AND APPLICATION SEASON FORECAST 2023- 2024: CASE STUDY OF SMALL HOLDER FARMERS IN TA NGABU CHIKWAWA

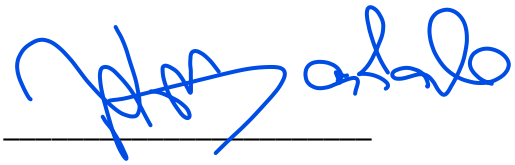
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JUNE, 2024

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Abstract

The aim of the research was to conduct a gap analysis on climate information services for the 2023-2024 seasonal forecast. The analysis focused on small-scale farmers' awareness of seasonal forecast information, the available communication methods, and the application of information in field work. The project employed a quantitative research approach. A total of 42 small-holder farmers were surveyed at random from two villages, Zamuntima and Nsomo, which are under TA Ngabu. Of these farmers, 78.6% received seasonal forecast information, while 21.4% did not. The majority of respondents 66.7% had completed primary education, while 33.3% had completed secondary education. The primary sources of information were radio and extension workers. The study revealed that 79.6% of farmers applied the seasonal forecast by diversifying their crops, planting early, planting short-maturing crops, and irrigating their crops. The SWOT tool was employed to identify the strengths, weaknesses, opportunities, and threats pertaining to the research objectives. The findings indicate that a comprehensive understanding of the advantages of seasonal forecasts and the assurance of financial security are essential prerequisites for farmers to implement them. It is evident that seasonal forecasts cannot address all of the challenges faced by smallholder farmers. Therefore, it is crucial to invest in capacity building initiatives to enhance productivity in the face of harsh climatic conditions. It is recommended that investment be made in the sesame cash crop, given the physiography of Ngabu and the installation of agrometeorological stations.

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I want to express my gratitude to my supervisor Dr V.Msadala for his remarks throughout the writing of the proposal to the final dissertation. I would like thank my mother, for whom I will always be grateful for supporting me during my time in college. I also want to express my gratitude to my family and anybody else who helped me along the way .Finally glory to God for his favor in my arrival and departure from the college.

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Acronyms/abbreviations

AAP	Africa Adaptation Program
ADDs	Agriculture Development Districts
CBA	Community Based Adaptation
CI	Climate Information
CIS	Climate Information Services
DCCMS	Department of Climate Change and Meteorological Services
DOA	District Officer Administrator
FA	Focus-Africa
GCOS	Global Climate Observing System
IRI	International Research Institute for climate and society
MUST	Malawi University of Science and Technology
NDJ	November-December-January
NGOs	Non-Governmental Organizations
OND	October-November-December
PSP	Participatory Scenario Program
SADC	Southern Africa Development Community
SF	Seasonal Forecast
SON	September-October-November
SPSS	Statistical Packages for Social Sciences
SWOT	Strengths ,Weakness, Opportunities and Threats
WMO	World Meteorological Organization

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Chapter 1:Introduction

1.1. Background of study

Malawi is an agrarian nation. Approximately 85% of the population are smallholder farmers and resides in rural areas. Due to their heavy reliance on subsistence farming, smallholder farmers are particularly susceptible to the negative effects of climate change, including altered duration of rainfall, long dry seasons, and shortened growing seasons. Food security and the agricultural value chain are threatened by this. Given the growing vulnerability of small-holder farmers to climate hazards, it is imperative that they receive timely and accurate seasonal forecast information. Their capacity to take preventative action, which is essential for lessening the vulnerability of communities that are vulnerable to disasters and preserving their means of subsistence, stems from the information provided. (ReliefWeb P. M.-M., 2021). People and communities are able to modify their agricultural practices in accordance with the expected climatic conditions if they are aware of projected weather conditions in advance. With this modification, communities are able to position themselves at an advantage and lessen impacts of climate variability. CIS are essential in creating and disseminating climate information, which communities need to know about the expected climate and take possible actions. DCCMS is responsible for the production of seasonal forecasts; however, it has always been challenging to effectively disseminate this climate information, especially to remote rural communities. The forecasts are frequently complicated, and it is challenging for non-scientists to understand the projection-related ideas that are present in climate forecasts. Consequently, communities often struggle to comprehend these forecasts and use the information to adjust to their farming practices to account for the predicted climate hazards (Brief, 2019). El Niño triggers dry spells that causes widespread crop failure. Ngabu was among regions in the southern Malawi to be

affected with El Nino conditions. Rising temperatures affects the water stress which leads to stunted crop growth. It was essential for the DCCMS to keep inspecting on the anticipated fluctuations in temperature and precipitation . This makes it possible for small-holder farmers to select the appropriate crop varieties and plan for good crop husbandry based on information from seasonal forecasts (PreventionWeb, 2016). Seasonal forecast information must be easily accessible in order to less impacts from weather hazards . Sound judgement that effectively lessen the negative effects requires having this information. The importance of using climate data to channel decisions has recently come to be recognized widely. (Harvey, 2019). Climate data can be shared in a variety of time intervals, from seasonal forecasts for the near future to longer-term climate projections. However, the complexity and style of presentation of climate data frequently make it difficult for small-holder farmers to understand it. Farmers struggle to understand the degree of complexity that are frequently connected to seasonal forecasts (Patt, 2002). Improved user-producer collaboration is necessary to develop accurate and personalized information . (Buontempo, Hewitt, FJ.Doblas-Reyes, & Dessai, In: Climate Risk Management, 2014). Climate services must necessitate the availability of pertinent data and a contextual understanding of the issue at hand (Goddard, 2016). Working together to ensure scientific validity, reliability, and meaningful for users is beneficial (Buontempo, Hewitt, FJ.Doblas-Reyes, & S, 2014), outlined as the three fundamental benchmarks for knowledge systems (Cash DW, 2003). This kind of knowledge generation requires new methods of working and, most importantly, involves cooperation between producers and users (Tembo-Nhlema, 2019).

1.2. Problem statement

The use of CIS to farming practice helps farmers to better manage climate and weather hazards (Antwi-Agyei.P, 2021). Farmers can more effectively plan their management strategies and allocate resources to address the anticipated climate event by using CI. (Meza. F. J., 2008). Even though it has been noted that small-scale farmers underuse CI, which has the ability to lessen the detrimental effects of climate and weather hazards on agriculture, its advantages are still substantial (Vogel.C, 2000). Several studies show that traditional mass media which are radio and television are a popular and widely used medium for disseminating CI (Burger. J., 2013).Due to low income capacity, farmers in rural areas have difficulty obtaining information from the media. This is mainly because they don't have the money to buy electronics, batteries, or stable power. They are consequently unable to keep up with significant issues of seasonal forecasts. Because the power supply in rural areas is inconsistent, farmers frequently resort to alternative energy sources like solar power or batteries to get around this problem. Still, their lack of access to these sources of electricity makes information even more difficult to obtain. Farmers greatly rely on second hand information because they easily share information among themselves and fellow farmers are easily approachable .Unfortunately, because they have limited access to trustworthy sources, this reliance on other people may result in the spread of false information. This is particularly challenging because many farmers struggle to fully comprehend the ideas of climate information (Elia.E, 2017).

1.3. Main objective

The main objective was :

To conduct a gap analysis in climate services and application for small-holder farmers.

1.4. Specific objectives

The specific objectives were:

1.To assess the level of awareness of 2023-2024 seasonal outlook.

2.To evaluate communication methods available to access climate information.

3.To assess the application of climate information in farming practices.

1.5. Significance of study

Ngabu, situated in the lower Shire region, is primarily populated by small-scale farmers who are involved in agricultural activities. Therefore, it was crucial to implement the project in this area as the study was centered on smallholder farmers. Given that Ngabu is the warmest area in Malawi, it is essential to provide farmers with timely and precise weather forecasts to enable them to make well-informed decisions, especially considering the harsh conditions they already encounter. Farmers grow subsistence crops such as maize, millet, vegetables, tomatoes, and sesame. Sesame, in particular, is a cash crop grown on a large scale. This crop is highly valued for its edible seeds contained within pods and has successfully adapted to tropical regions across the globe. Sesame flourishes in regions affected by drought, where other crops struggle to survive. Furthermore, sesame seeds have high oil content, making them a sought-after ingredient in various cuisines worldwide due to their flavorful and nutty taste. (Barode, 2022).Sesame has garnered global interest, leading farmers to anticipate increased profits due to the massive demand for the crop in Japan (Online, 2023).Despite the plant's ability to withstand severe Conditions ,it is vital to provide farmers with timely and precise weather updates .This information helps farmers understand rainfall patterns and make relevant decisions regarding planting, harvesting, and other necessary measures based on the seasonal forecast enabling farmers to enhance productivity and maximize profits.

Chapter 2:Literature review

1.6. Climate information services

Weather is the state of the atmosphere, which includes temperature, atmospheric pressure, wind, humidity, precipitation, and cloud cover. Weather is the localized atmospheric conditions that are experienced at a given location, whereas climate is the long-term average of the weather patterns that are observed over a period of about three decades. Weather patterns are significantly shaped by geography and regional conditions. In addition, the weather has a direct impact on what individuals choose to wear on a daily basis and how different structures are built (Geographic, 2023). Climate information (CI) is the gathering and examination of meteorological and climatic data along with historical and projected climate projections. It is pertinent that CIS provide accurate, timely, and information which provides information in a manner that makes decision-making sound and easy. The challenges presented by a changing and variable climate are anticipated and managed by users with the aid of CIS. For the purpose of this process, targeted user communities are to be given access to, interpretations of, communications about, and uses of accurate and trustworthy climate information. Additionally, feedback on the information's utilization has to be obtained (Services, n.d).Climate Services usually provides information in three main categories regarding the climate services (CS). These consist of early warning systems, forecasts, and agrometeorological services. Predictions are especially helpful for agricultural operations. Weather forecasts (daily to weekly), seasonal forecasts (1-6 months), short-term forecasts (1-5 years), intra-decadal/medium-term forecasts (5-10 years), and decadal forecasts are the five timescale forecasts that are most frequently used in the creation of climate risk warnings and risk response advisory services. The most commonly used forecasts among these are the seasonal, short-term, and weather forecasts (Ofoegbu, 2022). Seasonal forecasts offer information about possible anomalies and effects of the

climate up to a year ahead of time. These probabilistic forecasts show how likely it is that the forthcoming months will differ from past averages in terms of temperature, precipitation, or other variables like discharge (Impacts, 2021). It is not possible on a viewpoint based on science to provide precise daily forecasts one, two, or seven months in advance. On the other hand, seasonal forecasts shed light on general weather patterns and predict whether a particular location is most likely to expected normal - or below-normal precipitation over the course of coming months (Crawford, 2017). El Niño conditions, which are characterized by the abnormal warming of waters in the Eastern-Central Equatorial Pacific Ocean, were projected to influence 2023/2024 rainy season. The forecast for October 2023 to April 2024 was created by the DCCMS using a variety of factors influencing rainfall in Malawi. Normal rainfall levels were expected in Chikwawa from October and December 2023. However, there was greater likelihood of below-normal rainfall in November, especially in TA Ngabu, the start of planting rains was to delayed by according to seasonal forecast. (ReliefWeb M. t.-2.-M., 2023).

1.7. Seasonal forecasts

SFs are anticipated possibility odds of a prospect; they hinge on the likelihood that normal ,below and above conditions below will take place. They are produced using ensemble models which projects over a time step of five months (Wilk. J., 2017). Ensemble modeling is a process whereby a couple of different models are run to project an outcome using data sets and mathematical computations. Ensemble modelling comes up with a final projection. The reason for using ensemble modelling is to minimize generalization errors of the projection (Topics, 2018).The encapsulate statistics from different simulations are shown in the SF and comparison takes place with long-term mean values made using the similar model. They are composed as three-month periods trailing with a single month such as SON,OND and NDJ. Maps present forecasts of precipitation , minimum and maximum temperature at a scale of 1:200,000 with information in grids of 1000 x 1000m. SF display the likelihood for normal, above normal and below normal conditions to happen in comparison with long term average historical archives. A probability percentage for every forecast map made within the three-month period ranges between 0% to 50%.The probabilities posits the forecasts direction and the weight of composure in them. The maps go along with short texts in English that condenses the displayed details. It can happen that a location be assigned below normal and above normal conditions for the similar time scale. Though one projection should stand out sometimes conflicting scenario are shown.SFs go along with proposed actions for rainfed crop productions, irrigated farming, domestic and home garden water use. They provide an overview and outline a number of recommended activities that are not particularly sync to the projected conditions of the upcoming months. A text shows that given advisories are general guidelines and should farther be clarified to the region downscaled characteristics (Wilk. J., 2017).

1.8. Climate services in Malawi and gap analysis projects

Gap analysis involves examining the disparities between established standards and their actual implementation. (Encyclopedia.com, n.d). There are four stages in the gap analysis which are assessing the present situation, identifying the desired future outcome, identifying the gaps, and proving solutions to bridge the gap (Team, 2018).The objectives of the project were in par with the 2019 National Meteorological Policy, which aims to ensure the timely distribution of accurate and reliable sector-specific information for early readiness and facilitating the production of dependable, adaptable, excellent, timely, and current weather and climate services (POLICY G. O., 2019). DCCMS started an organized network of stations in the mid-1940s to provide weather information primarily for aviation services. This marked the beginning of Malawi's establishment of an efficient climate information system. As the need for meteorological data grew beyond what was needed for aviation, more stations were built to accommodate the demands of different industries. There are currently eight ADDs with twenty-two meteorological stations and twenty-one subsidiary agrometeorological stations placed in strategic locations (ADDs). In order to support development initiatives in the various fields the DCCMs has expanded the network of its stations over time. In Malawi, this department is the official entity tasked with keeping an eye on, forecasting, and sharing weather, climate, and climate change-related information. Due to the lack of specialized training programs provided by nearby universities, Malawi's climate information system was experiencing a staffing shortage in the field of managing climate change. The lack of content related to CIS in primary and secondary school curricula hindered national programming efforts because insufficient expertise was needed to create and execute successful programs related to climate change. Despite these challenges, the Malawian government organized training sessions for local communities to increase their knowledge of climate change issues. These sessions have been carried out in partnership with academic institutions and non-governmental organizations (Ozor .N, 2021). In order to meet the demand for expertise in climate information systems, the Malawi University of Science and Technology (MUST) also introduced

a meteorology and climate science course. For many people in Malawi, small-scale farming is major source of income, but it is susceptible to the impacts of climate variability. In order to enhance Climate Information Services, experts and community members collaborate through the PSP. Stakeholders examine climate projections and create suggestions for modifying agricultural practices through workshops. This is in line with Community-Based Adaptation (CBA) approaches, which seek to involve the public in the process of interpreting climate data. Although PSPs have been effective in Malawi, official policies have not fully incorporated them. For long-term efficacy, issues like warning communication and monitoring and assessment must be resolved. The creation of a centralized CIS platform via the incorporation of PSPs into national budgets and policies can facilitate PSP implementation nationwide. This will increase PSPs' sustainability and guarantee that communities have access to pertinent climate data to strengthen their capacity for adaptation (Brief, n.d). It is necessary to gradually improve the country's capacity to control climate hazards in order to guarantee the efficacy of climate services. The continuous initiatives to increase capacity for climate services must be expanded, better coordinated, and adapted to the unique requirements of each region .The FA is another project that particularly focuses on recognizing and dealing with the gaps that currently exist in generating and supplying climate services within the SADC countries in order to address the challenges in capacity building. The project draws attention to difficulties in managing and processing climate data as well as in tracking and assessing climate services. An assessment conducted by FA identified knowledge gaps and resources regarding data recovery, index generation, statistical and dynamic downscaling, model output interpretation and verification, impact-based forecasting, performance evaluation, quality assurance and control, driver detection and analysis, and predictor definition and identification (Jansen, 2022). GCOS and the IRI also carried out a thorough gap analysis in 2005. This analysis concentrated on recognizing the shortcomings in climate services and data and the challenges in integrating climate change into large-scale policy and practice. The gaps that were identified remain pertinent in the current context even though they were published almost a decade

ago. IRI has actively worked to address these significant issues over the past ten years in Africa through a variety of projects and partnerships (Dinku, 2014).

Chapter 3:Methodology

1.9. Study area

Ngabu is situated in the Chikwawa district in Malawi's southern region. Exact geographical coordinates are -16.4404738 and 34. 869314 longitude and latitude respectively.

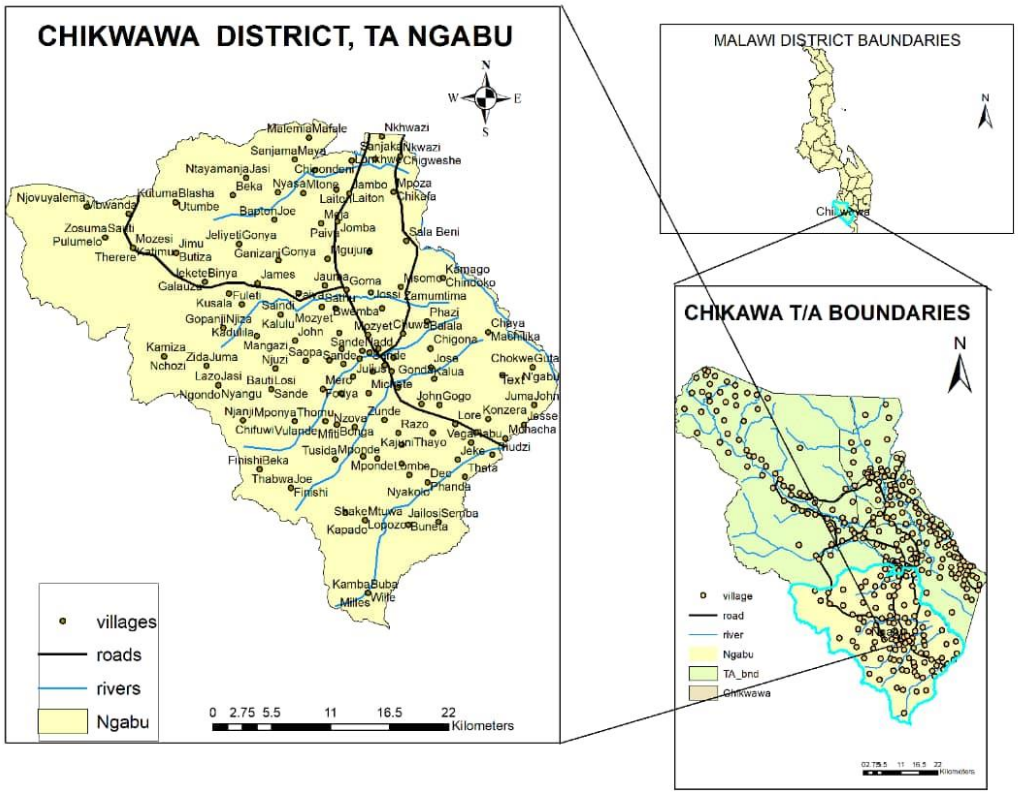


Figure 1:Map of Chikwawa district TA Ngabu

1.10. Sample size

The sample size was calculated using a population of 50 farmers. A sample size of 42 was calculated using a population proportion of 0.5, a confidence level of 95%, and a margin of error of 6%.

1.11. Materials and methods

The project employed a quantitative research methodology. A total of 42 smallholder farmers were surveyed at random from two villages, Zamuntima and Nsomo, which are under the jurisdiction of TA Ngabu. The survey was conducted in Chichewa by means of an interpreter, who translated the questions from English into Chichewa. Prior to the day of data collection, the lead farmer for Zamuntima and Nsomo was contacted to assist in the organisation of the farmers, with the aim of ensuring their presence at a single location. This approach was intended to facilitate the survey process and to minimise the cost of transport over long distances looking for farmers. On the following day, all farmers convened at Linga Primary School, where they were interviewed using a questionnaire that had been uploaded to a smartphone. The interviews focused on the awareness of small-holder farmers regarding the 2023-2024 seasonal forecast, the application of information in farming practices, and the methods of communication used to access the information. The SWOT analysis was employed as a tool to conduct the gap analysis. Permission was granted by the Malawi University of Science and Technology (MUST) and the District Officer Administrator (DOA) in Chikwawa district to enable the data collection.

1.12. Data collection and analysis

The responses of the respondents were uploaded to the Kobo toolbox. An XLS file containing XML values and SPSS label documents was exported into the SPSS software. Descriptive statistics and frequencies were employed to create tables, graphs, and lines.

Chapter 4: Results and discussion

1.13. Personal characteristics of the small-holder farmers

Table 1:List of small-holder farmers.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farmer 1	1	2.4	2.4	4.8
	Farmer 2	1	2.4	2.4	2.4
	Farmer 3	1	2.4	2.4	7.1
	Farmer 4	1	2.4	2.4	9.5
	Farmer 5	1	2.4	2.4	11.9
	Farmer 6	1	2.4	2.4	14.3
	Farmer 7	1	2.4	2.4	16.7
	Farmer 8	1	2.4	2.4	19.0
	Farmer 9	1	2.4	2.4	21.4
	Farmer 10	1	2.4	2.4	23.8
	Farmer 11	1	2.4	2.4	26.2
	Farmer 12	1	2.4	2.4	28.6
	Farmer 13	1	2.4	2.4	31.0
	Farmer 14	1	2.4	2.4	33.3
	Farmer 15	1	2.4	2.4	35.7
	Farmer 16	1	2.4	2.4	38.1
	Farmer 17	1	2.4	2.4	40.5
	Farmer 18	1	2.4	2.4	42.9
	Farmer 19	1	2.4	2.4	45.2
	Farmer 20	1	2.4	2.4	47.6
	Farmer 21	1	2.4	2.4	50.0
	Farmer 22	1	2.4	2.4	52.4
	Farmer 23	1	2.4	2.4	54.8
	Farmer 24	1	2.4	2.4	57.1
	Farmer 25	1	2.4	2.4	59.5
	Farmer 26	1	2.4	2.4	61.9
	Farmer 27	1	2.4	2.4	64.3
	Farmer 28	1	2.4	2.4	66.7
	Farmer 29	1	2.4	2.4	69.0
	Farmer 30	1	2.4	2.4	71.4
	Farmer 31	2	4.8	4.8	76.2
	Farmer 32	1	2.4	2.4	78.6
	Farmer 33	1	2.4	2.4	81.0
	Farmer 34	1	2.4	2.4	83.3
	Farmer 35	1	2.4	2.4	85.7
	Farmer 36	1	2.4	2.4	88.1
	Farmer 37	1	2.4	2.4	90.5
	Farmer 38	1	2.4	2.4	92.9
	Farmer 39	1	2.4	2.4	95.2
	Farmers 40	1	2.4	2.4	97.6
	Leader 41	1	2.4	2.4	100.0
	Total	42	100.0	100.0	

The table above presents the results of a survey of 42 small-holder farmers, conducted in conjunction with 6 lead farmers who are responsible for at least 7 farmers each.

Table 2: Residence of farmers

Names of Villages	Frequency	Percent	Valid Percent	Cumulative Percent
Chiwembu sub group	12	28.6	28.6	54.8
Kachembere sub group	1	2.4	2.4	31.0
Kachigwe sub group	5	11.9	11.9	83.4
Kumwembe sub group	2	4.8	4.8	47.6
Mpinganjira sub group	9	21.4	21.4	69.0
Msomo TA	8	19.0	19.0	88.1
Zamuntima TA	5	11.9	11.9	100.0
Total	42	100.0	100.0	

The table above illustrates the residential locations of the farmers. The majority of respondents were from Chiwembu village under TA Msomo, representing 28% of the total. One respondent was from Kachembere under TA Zamumtima, representing 2.4% of the total.

Table 3:Gender of the respondents

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	21	50.0	50.0	50.0
Male	21	50.0	50.0	100.0
Total	42	100.0	100.0	

The above figure demonstrates that farmers surveyed were equally represented by gender. This is a significant finding, as it indicates that both genders are engaged in matters pertaining to farming. This enables them to devise strategies to adapt to changing weather patterns by ensuring that no one is left behind.

Table 4: Level of education for the respondents

Education	Frequency	Percent	Valid Percent	Cumulative Percent
Primary	28	66.7	66.7	66.7
Secondary	14	33.3	33.3	100.0
Total	42	100.0	100.0	

The table above illustrates that a greater proportion of individuals possess primary education (66.7%) compared to those with secondary education (33.3%). This has

implications for their ability to source information independently and utilize complex technologies. Education enables farmers to adopt an innovative approach, which is of significant importance in the context of risk management. Education fosters problem-solving abilities and instills a sense of resilience in the face of risk. Educated farmers are more likely to be innovators and to contribute their ideas to those with less education. (Knight.J, 2003).

1.14. Awareness, communication methods and use of information

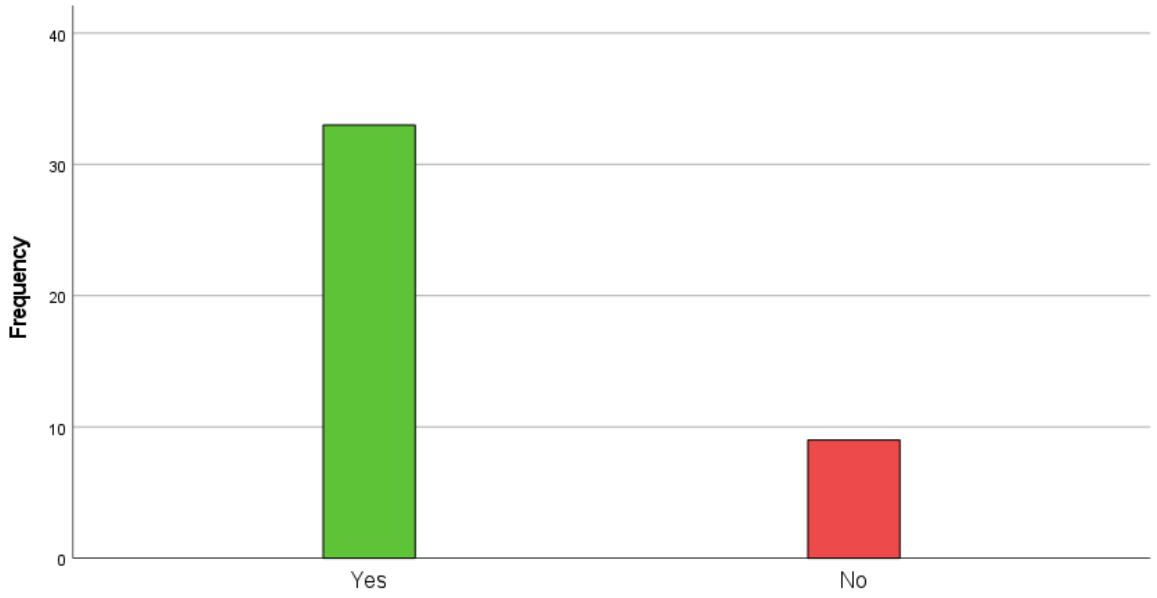


Figure 2:Respondents who received and did not receive information.

The graph above illustrates that a greater proportion of farmers received the seasonal information forecast (78.6%) than did not (21.4%). The reasons for not receiving the information were lack of awareness and lack of gadgets to source out information. The data indicates that 78.6% of people had access to the seasonal forecast information.

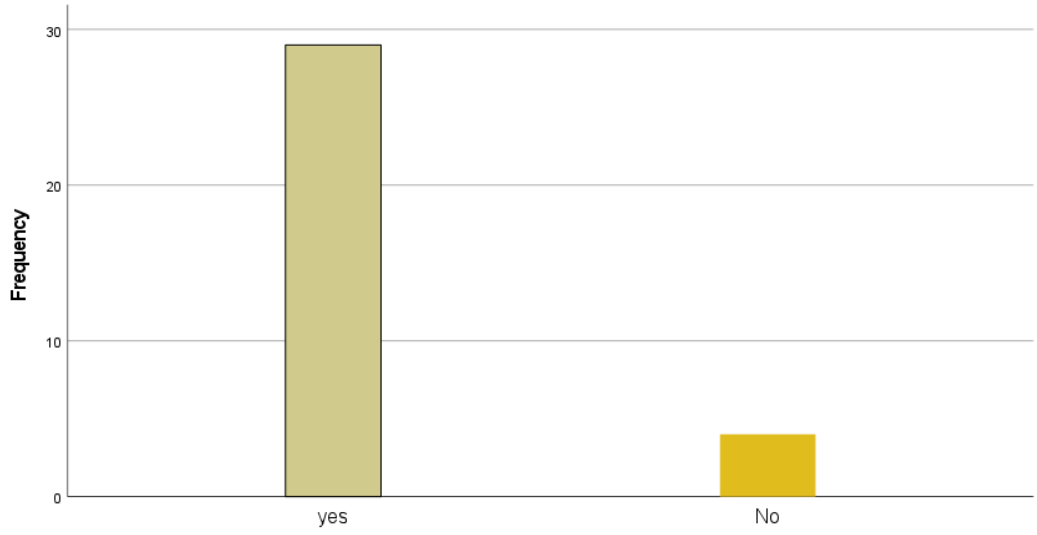


Figure 3:Knowledge of El-nino

The graph above illustrates that a greater proportion of farmers were aware of El Niño than were not. This was beneficial in enabling them to prepare accordingly. Of those surveyed, 87.9% were aware of El Niño, while 12.1% were not.

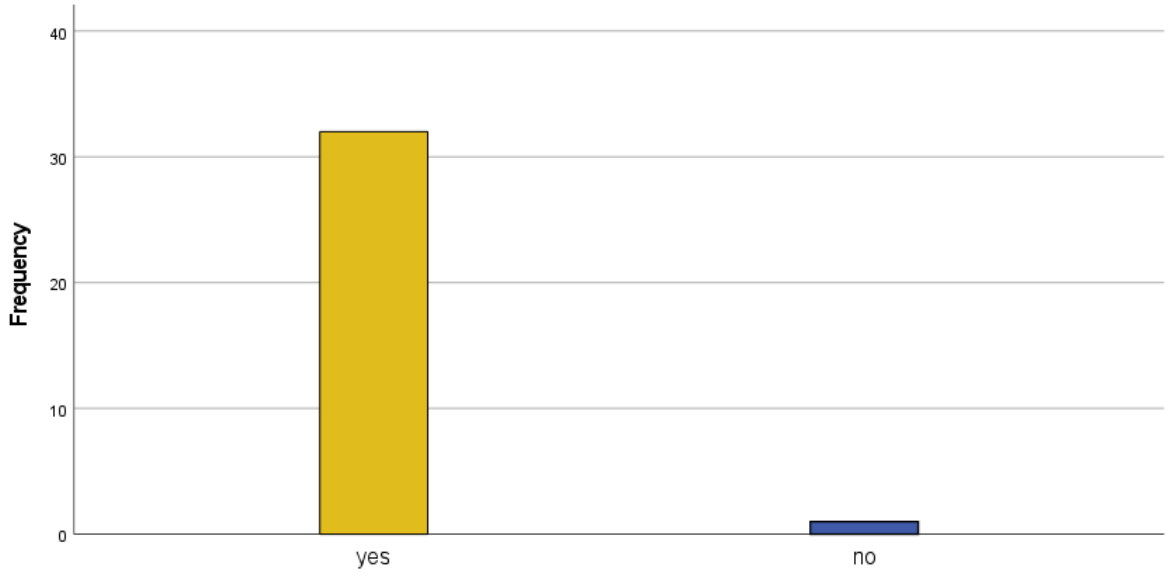


Figure 4:Knowledge of normal and below normal rainfall .

The figure above illustrates that the majority of farmers were aware that the region would experience normal or below-normal rainfall.

Table 5:Respondents who applied and did not apply the information

	Frequency	Percent	Valid Percent	Cumulative Percent
yes	33	78.6	100.0	100.0
No	9	21.4		
Total	42	100.0		

The table above indicates that 78.6% of farmers utilized the information, while 21.4% did not. Those who utilized the information were numerous, suggesting that a significant proportion of farmers were able to apply the information and the importance of seasonal forecast information in fieldwork cannot be underestimated. Those who did not utilize the information were among those who did not receive the forecast information in the first place.

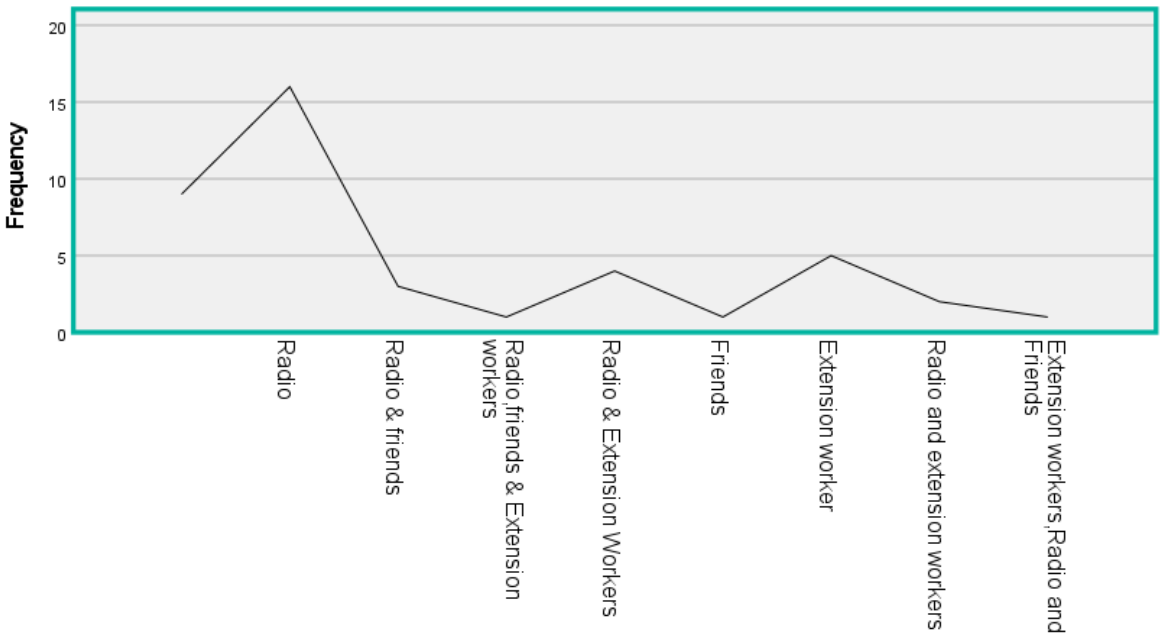


Figure 5:Methods of communication

The graph above illustrates that 16 farmers received the forecast information from radio, representing 38.1%. Nine smallholder farmers did not receive the forecast information, representing 21.4%, while 11.9% of extension workers did not receive the forecast. Radios were used to access the forecast information, yet radios are expensive, and those who did not receive the forecast were among those who did not have a radio. Extension workers also played a significant role in the dissemination of seasonal forecast information.

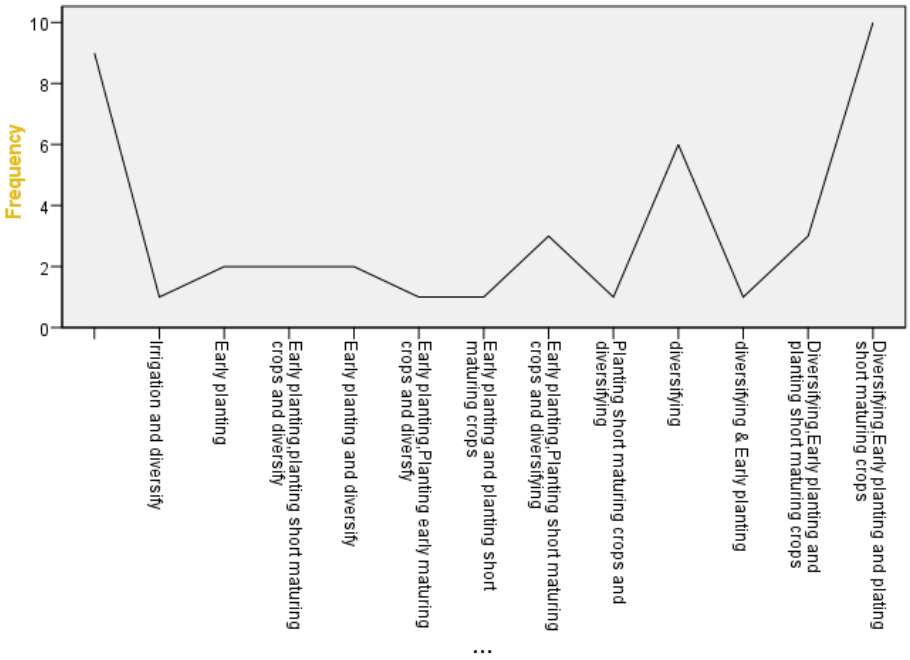


Figure 6: Farming practices used in relation to information received.

The graph above illustrates that 79.6% of farmers applied the seasonal forecast by diversifying, planting early, planting short-maturing crops and irrigation. Nine farmers were unable to apply the information due to a lack of receipt of the forecast, representing 21.4%.

1.15. SWOT on awareness, methods of communication and application

Table 6: SWOT for awareness of seasonal forecast .

STRENGTHS	WEAKNESSES
Availability of radios Availability of active lead farmers Availability of agricultural extension workers	Low digital literacy skills
OPPORTUNITIES	**THREATS**
Training workshops	No Electricity

The table illustrates the strengths that are available based on the awareness of the seasonal forecast. These include the availability of radios, active lead farmers and agriculture extension workers. These modes of communication are vital in terms of awareness of seasonal forecast information. It is recommended that training workshops be held in rural communities to enhance farmers' awareness of seasonal forecasts. The lack of digital literacy is a significant challenge in this context. The limited access to mobile phones and the internet, coupled with the lack of electricity, presents a significant obstacle to the development of digital literacy.

Table 7:SWOT for application of information into field work

STRENGTHS	WEAKNESSES
Capable to access the information Capable to use climate information	Lack to resources to use the information into farming operations Frustration based on how crops perform this year because of the dry spells
OPPORTUNITIES	**THREATS**
Holding workshops and sensitization campaigns	Frequently occurring dry spells

The preceding table illustrates that farmers are able to access and utilize information. Furthermore, the implementation of workshops and sensitization campaigns can facilitate the dissemination of information regarding the enhancement of the utilization of information and the value of climate information. It is evident that the motivation to utilize seasonal forecast information is contingent upon the individual's awareness of the advantages of such forecasts, as well as their financial security with regard to farming activities and the conditions of the location in question. (Millner.A., 2011).

Table 8: SWOT for communication methods used to access information.

STRENGTHS	WEAKNESSES
Presence of media sources Presence of agricultural extension workers	Exiguous electronic gadgets Low digital literacy
OPPORTUNITIES	**THREATS**
Trainings on digital literacy Training workshops especially for lead farmers	The villages are in a remote location.

The preceding table illustrates the potential for smallholder farmers in rural communities to access information through the availability of media sources and agricultural extension workers. Furthermore, there are opportunities to train lead farmers and to hold workshops to train farmers on new ways to source information. The limited availability of electronic devices and low digital literacy represent a significant challenge in these rural communities, which are often situated in remote

locations. This may impede the timely dissemination of information to farmers by extension workers. The National Meteorological Policy asserts the relevance of digital technology to all farmers throughout the country, with the objective of enhancing accessibility to climate information. However, these farmers are situated at a greater distance from this reality.

Chapter 5:Conclusion and recommendations

1.16. Conclusion

The results demonstrate that a greater proportion of farmers in the villages under TA Ngabu were able to access climate information. This is of significant importance with regard to farmers' decision-making and productivity. The majority of farmers obtained the information from radios and extension workers. Forty-two farmers received the information, while nine farmers did not receive the seasonal forecast due to a lack of electronic gadgets and some farmers were not interested in the seasonal forecast because they did not engage in farming during the growing season. Those farmers who received the seasonal forecast information were able to apply it to their fieldwork by diversifying and planting with the early rains. Overall, the results were positive, but it should be noted that seasonal forecasts are not a panacea; they only help farmers to know the future conditions and plan accordingly. However, with the severity of the El Niño condition, most of these smallholder farmers lost crops due to dry spells. The issue of capacity building now arises in the context of farmers who have followed and planned accordingly based on the caveats from the seasonal forecast, yet remain food insecure.

1.17. Recommendations

The level of awareness regarding climate information among the inhabitants of the villages under T.A Ngabu is commendable. It is evident that digital literacy is of paramount importance, given the ease of accessibility and timely availability of information. The advent of digital literacy coincides with the installation of electric power and even solar energy. While the installation of electricity in these villages may take some time, it is important to ensure that farmers are not left behind. The formation of cooperatives represents an effective initial step in the process of digital literacy sensitisation. The availability of active lead farmers plays a significant role in the training of other farmers, as they represent a group of farmers. Organising digital literacy workshops is a significant step in bridging the digital literacy gap and ensuring that farmers remain up-to-date. Radio programmes disseminate information on seasonal forecasts at a large spatial scale, but information downscaled to the level of individual regions may not be accessible to farmers unless the DCCMS organises workshops to inform them of their region's projected conditions. New and innovative measures must be implemented in order to effectively overcome the detrimental effects of frequently occurring dry spells. One potential solution is to invest in sesame crops, as the physiography of Ngabu is not conducive to maize cultivation, but sesame thrives in the region. Sesame is an important agricultural crop. Sesame is particularly suited to tropical savanna conditions and exhibits optimal growth in arid environments with minimal moisture. (Bourke. M., 2004). Although few farmers currently employ this practice, if it were to be adopted by the majority, it would ensure that, regardless of dry spells, farmers would be able to grow sesame and other crops and remain food secure. Another strategy is to provide farmers with communication tools that are appropriate for their needs. This entails providing tools that are suited to their income and knowledge. (Nantoume, n.d). Short Message Service (SMS) is a common method of disseminating climate information. Furthermore, the installation of an agrometeorological station in the area is also required. The installation of a weather station enables farmers to monitor the state

of the land and to make more informed decisions regarding the use of the information they gather. This, in turn, has the effect of reducing operational expenses and promoting more successful farm management. (Stations, n.d).

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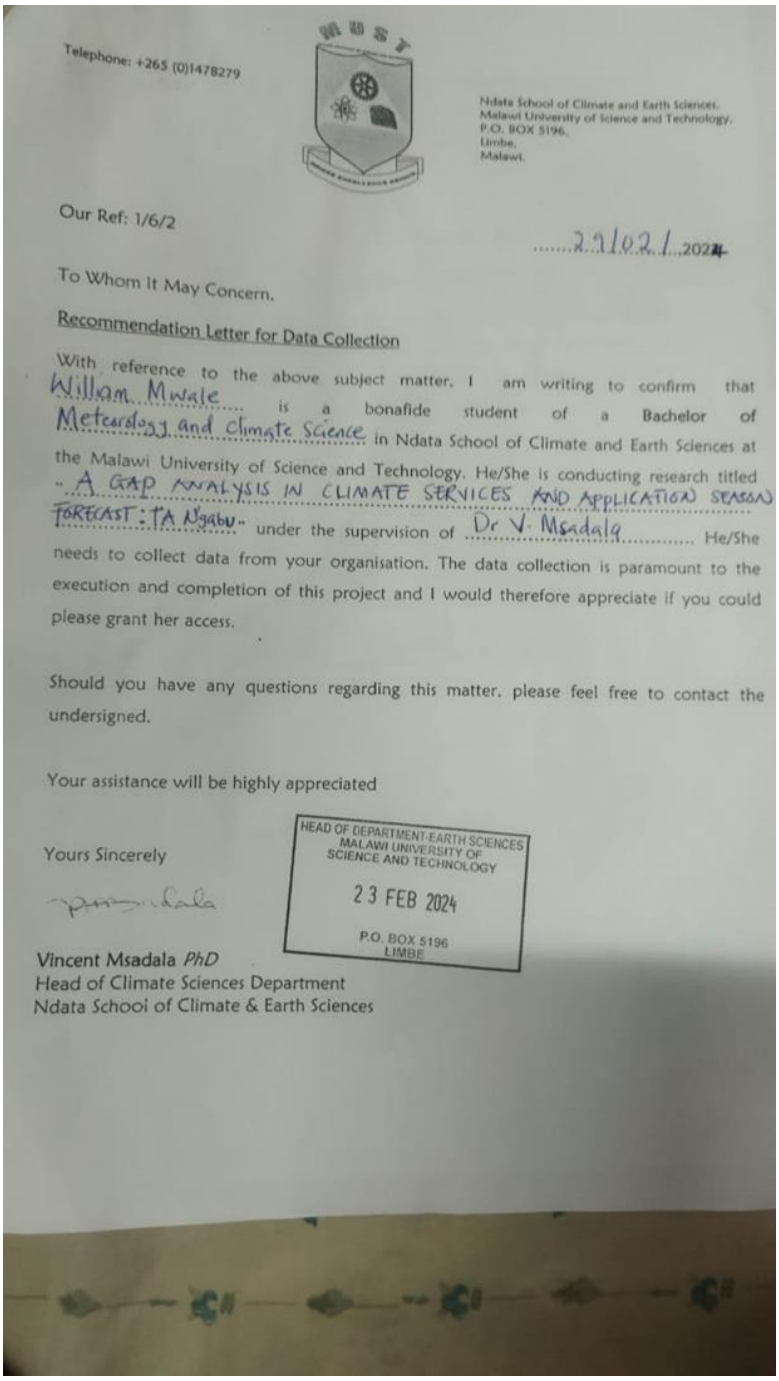
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Appendix

1.18. Ethical letters



Telephone: +265 (0)1478279

MUST

Ndata School of Climate and Earth Sciences,
Malawi University of Science and Technology,
P.O. BOX 5196,
Limbe,
Malawi.

Our Ref: 1/6/2

.....29/02/2024

To Whom It May Concern,

Recommendation Letter for Data Collection

With reference to the above subject matter, I am writing to confirm that William Mwale is a bonafide student of a Bachelor of Meteorology and Climate Science in Ndata School of Climate and Earth Sciences at the Malawi University of Science and Technology. He/She is conducting research titled "A GAP ANALYSIS IN CLIMATE SERVICES AND APPLICATION SEASON FORECAST: TA Ngabu" under the supervision of Dr V. Msadala. He/She needs to collect data from your organisation. The data collection is paramount to the execution and completion of this project and I would therefore appreciate if you could please grant her access.

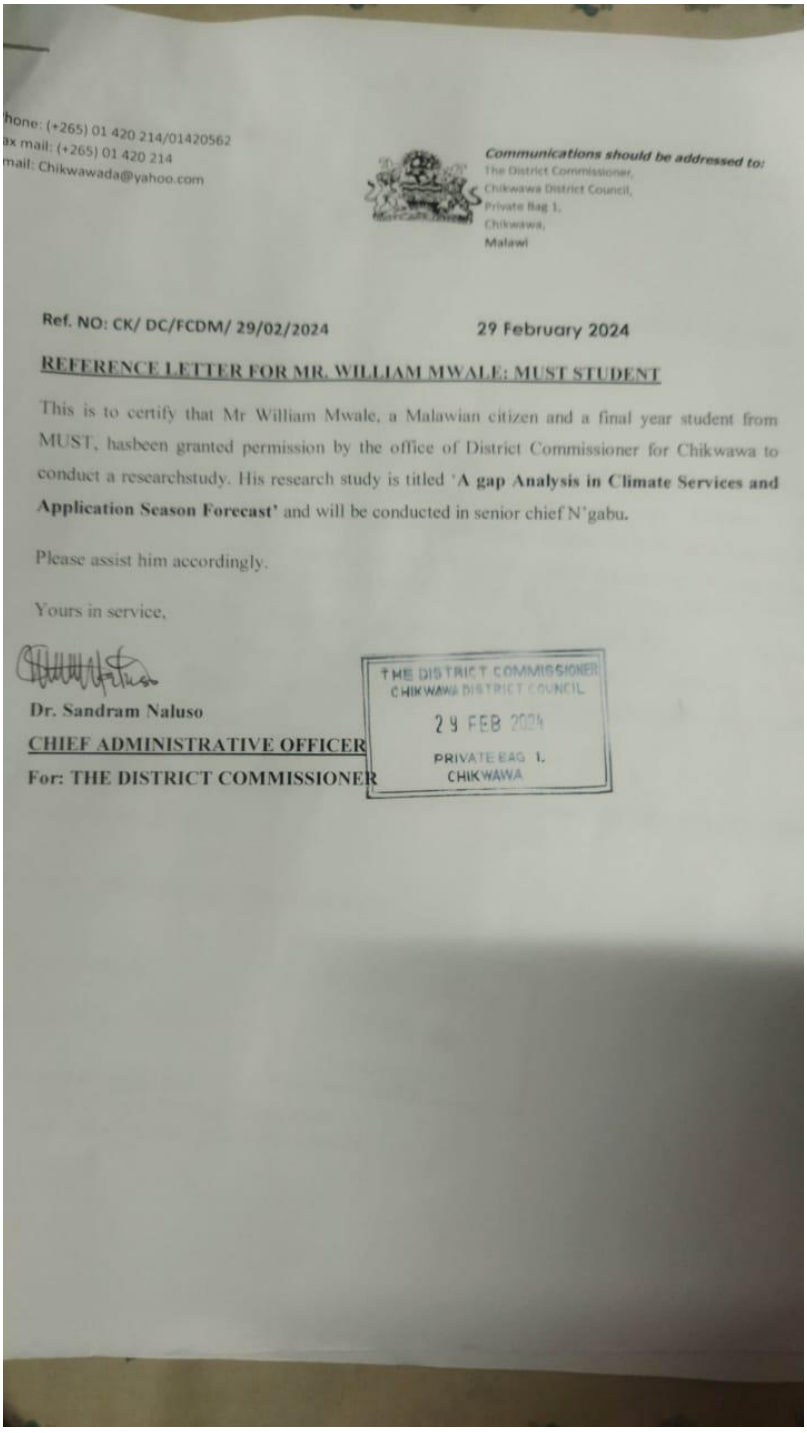
Should you have any questions regarding this matter, please feel free to contact the undersigned.

Your assistance will be highly appreciated

Yours Sincerely

HEAD OF DEPARTMENT-EARTH SCIENCES
MALAWI UNIVERSITY OF
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23 FEB 2024
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Communications should be addressed to:
The District Commissioner,
Chikwawa District Council,
Private Bag 1,
Chikwawa,
Malawi

Ref. NO: CK/ DC/FCDM/ 29/02/2024 **29 February 2024**

REFERENCE LETTER FOR MR. WILLIAM MWALE: MUST STUDENT

This is to certify that Mr William Mwale, a Malawian citizen and a final year student from MUST, hasbeen granted permission by the office of District Commissioner for Chikwawa to conduct a researchstudy. His research study is titled '**A gap Analysis in Climate Services and Application Season Forecast'** and will be conducted in senior chief N'gabu.

Please assist him accordingly.

Yours in service,

Dr. Sandram Naluso
CHIEF ADMINISTRATIVE OFFICER
For: THE DISTRICT COMMISSIONER

THE DISTRICT COMMISSIONER
CHIKWAWA DISTRICT COUNCIL
29 FEB 2024
PRIVATE BAG 1,
CHIKWAWA

1.19. Questionnaire

full name full address G

ender

Male Female

Level of education?

Primary Secondary Tertiary

Age Range

Between 20 and 30 Between 40 and 90

SEASONAL FORECAST FOR SMALESCALE FARMERS TA NGABU

FIRST DETAILS

Did you receive any information of the 2023-2024 seasonal forecast?*

Yes No

Received

Did you know that the rainfall season was expected to be influenced by moderate to strong El nino?*

yes No

Did you know that seasonal length of rainfall was expected to be around 100 to 120 days?*

yes No

Did you know that Ngabu was expected to receive normal and below normal rainfall according to the 2023-2024 season forecast?*

yes no

Did the seasonal forecast information find you timely?*

yes No

Have you been receiving climate information climate information in the past years?*

○ Yes ○ No

How did you get to know about the seasonal forecast information?*

☐ National meteorological station ☐ Radio ☐ Television ☐ friends ☐ Other organizations ☐ Newspaper

Did you use this information in making any farm management decisions?*

○ yes ○ no

What kind of farm management decisions/activities did you use in relation to the normal and below normal rainfall amounts as projected from the seasonal forecast?*

☐ Irrigation ☐ Early planting ☐ short-maturing crop varieties ☐ Diversifying crops

Which of the following best describes the accuracy of that forecast? [Tick the most appropriate]*

○ Very Accurate ○ ○ Somewhat Accurate ○ Not Accurate

Did you receive any advisory accompanying the forecast for your area with reference to crops and livestock?*

○ yes ○ no

TRADITIONAL CLIMATE INFORMATION

Are there traditional/customary methods of predicting climate in your area?*

○ yes ○ no

Would you use it in combination with the meteorological information or separately?*

○ yes ○ no

Given a choice, which information would you use first?*

○ meteorological information ○ Traditional

Why didn't you receive the forecast?*

☐ not aware ☐ not interested ☐ Other

What did you base your farm management decisions on that season?*

○ Indigenous Knowledge ○ Not at all

Which of the following best describes your farm's performance (production) during that season compared to a similar season when you had the forecast information: (Tick the most appropriate)*

Higher Same Lower

How useful do you think this information would be to your farm operations?*

very useful less useful