A Comparative Analysis of Perception Levels of Accuracy for Indigenous Weather Forecasts and Meteorological Forecasts: The Case Of Wards 12 And 13, Mberengwa District, Zimbabwe

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Abstract

Residents of wards 12 and 13 in Mberengwa depend on subsistence agriculture for their livelihoods. These residents incorporate weather forecasts in agricultural decision-making especially in decisions that relate to crop production. The residents of the two wards, have since developed their own indigenous weather forecasting systems that they use in conjunction with meteorological weather forecasts for agricultural planning purposes. This study examines the perceptions of the residents of wards 12 and 13 on the levels of accuracy of indigenous and meteorological weather forecasts. The data was collected using questionnaires and focus, group discussions. Purposive sampling was used to select the respondents. 66% of the respondents indicated that indigenous weather forecasts' accuracy fell in the 'average' to 'good' rating while 59 % indicated that they rated meteorological weather forecasts as 'average' to 'good'. Comparative ratings of the accuracy of indigenous weather forecasts to meteorological weather forecasts showed that 91% of the respondents who had access to both meteorological and indigenous weather forecasts perceived the indigenous weather forecasts as being more reliable than meteorological weather forecasts. The study recommends an in-depth *research of the indigenous weather forecasting systems so that the locals may fully benefit from this simple, inexpensive and easily accessible system of weather forecasting.*

Key words: Accuracy, indigenous weather forecasts, meteorological weather forecasts

Introduction

In recent years it has become evident that conventional agricultural practices cannot consistently be applied to different agricultural zones. The failure rate of such attempts has been alarming. This has resulted in greater attention being paid to indigenous forecasting systems, hence the need to evaluate their efficiency (Hart and Mauton 2005). Indigenous knowledge systems are essential for effective agricultural decision making processes and, therefore effort must also be made to build on farmers' Indeigenous Knowledge Systems (IKS). Short range and long range forecasts such as daily weather forecasts and seasonal rainfall forecasts are derived from environmental indicators which include birds, animals or creatures, vegetation, celestial bodies and prevailing weather conditions. Prevailing weather conditions are used to derive daily weather forecasts and seasonal rainfall forecasts, while the state of celestial bodies, vegetation types and birds' behavioral signs are also used for the same purpose. Locals observe closely the different activities or behaviours of birds and animals to derive indigenous weather forecasts (Stigter, Dawei,Onyewetu and Xurong, 2005). An example of a bird indicator is the lapwing bird *(Tatihari)* found in Australia. When it lays its eggs on the upper part of the river then good rains are expected and poor or no rains are expected when it lays eggs on the lower part of the river. It is further believed that if it lays one egg then rains will fall for one month and two eggs imply that rains will fall for two months. Camels are also used to predict the weather. When there is a swelling on the lower parts of the camel's legs, rainfall is expected any time. Creatures such as centipedes and spiders are also used as weather predictors (Hall, 2007). In the northern parts of India it is culturally believed that strong easterly winds mean the rainy season has come. A rainbow that forms in the direction of Bengal implies that rain might fall by evening if not, definitely it will fall by the next morning. During the rainy season, if cloud appears on Friday or Saturday, then rainfall is predicted for either Sunday or Monday, (Ajibade and Shokemi 2003). Aborigines have a philosophy that all things are connected and that subtle natural linkages are present which can reveal much about the climate and weather, so they derive their weather forecasts from environmental indicators. Ajibade and Shokemi (2003) concluded that the use of *Iks* should be seen as complementary rather than contradictory to western methods. According to studies carried out by UNEP (2002), the Hausa of Northern Nigeria, for example, developed a wealth of *Iks* to cope with vulnerability to drought and famine in sub-humid to arid regions of the Sahel. Lucio, Ngugi, and Shumba (1999) cited in Kihupi *et al* (2003), carried out a study in Tanzania and also concluded that over the years peasant farmers and pastoralists alike have developed their own climate prediction schemes based on observations of the behavior of the surrounding natural environment.

Mararike (1999) discusses the use of Indeigenous Knowledge Systems in predicting rain or drought in Zimbabwe. He postulates that people try to make meaning out of the environment in which they live. This knowledge is key to any planning process at the lowest level and enables decision makers to act timeously. Studies carried out by Mararike (1999) in Buhera district reveal that there are a lot of indicators to predict impending rain or drought, for example, the singing of the rain cuckoo *'haya'* in the early summer is believed to herald the start of the rainy season. These Indeigenous Knowledge Systems exist in wards 12 and 13 of Mberengwa but their accuracy has never been established. Knowledge of how accurate these Indeigenous Knowledge Systems are is vital for Zimbabwe and Africa's development particularly for development of strategies on coping with droughts. Residents of wards 12 and 13 in Mberengwa rely on indigenous weather forecasting systems and conventional Meteorological forecasts to determine the quality of the rainfall season to be expected (Shoko 2009, unpublished). The residents incorporate this information in their agricultural decision making. Wards 12 and 13 in Mberengwa are in agro-ecological region IV where rainfall is unreliable and inadequate (Vincent and Thomas 1961). Strategic decision making and planning processes such as when to plant and which crops to grow for a particular year are all effectively made to a greater extent using weather information derived from indigenous indicators. Livestock numbers, water resources and pasture management all depend on weather forecasts and in particular, rainfall forecasts. In the light of the situation described above, it is imperative that research be carried out to establish the users' perceptions of the accuracy of both the indigenous and meteorological forecasts and to find out how much they value each product.

Justification of the study

Wards 12 and 13 are located in agro-ecological region IV, where the rainfall is erratic and highly unreliable. Annual precipitation amounts range from 400 to 600 mm (Vincent and Thomas 1961). Despite the fact that rainfall is a limiting factor, the residents of these wards have an agro-based livelihood. Timely planting, selection of appropriate crop cultivars and an effective animal husbandry system are essential to achieve increased yields. Success in agriculture is facilitated by an adept decision–making system which is precise, dependable and easy to apply. The residents have two types of decision making tools namely, indigenous weather forecast products and meteorological weather forecast products Shoko(2009),identified the indigenous forecasting systems that are used in conjunction with Meteorological forecasts by the residents of wards 12 and 13 in Mberengwa. The current study set out to compare the residents' perceptions of the accuracy of the two products they use and to determine the value that they attach to each product in terms of making agricultural decisions. The value of the product can be inferred from how accurate the locals think it is in terms of predicting the weather. The findings would be useful in developing a community preferred product which the residents own and are part and parcel of. It was hoped that this would ensure high adoption rates of the products and consequently promote food security in the area. The findings would also establish whether the two forecasting products have a significant role in agricultural decision making and whether these systems are worth developing as perceived by the residents.

Area of study

Mberengwa is a district in Zimbabwe situated 180 kilometres south of Gweru and 24km southwest of Zvishavane in agro- ecological farming region IV. The majority of the people in this area depend wholly on farming for their survival. Farming in this area is however affected by rainfall variability that ranges from 400-600 mm per year and can fall significantly to the lower values. The length of the growing season is only about 111 days. Droughts are very common in this area and it has been noted that there are usually 4 moderately dry years in 5 years, which means there is only one good season in 5 years. Mid-season droughts are also very common. Intra-season dry spells occur without fail even during wet years and the average is about 10-20 days mainly in January. The wards comprise six villages and the population is about 5987 (CSO, 1992). There are 948 households in the wards. Figure 1 shows the study area.

Map of the study area

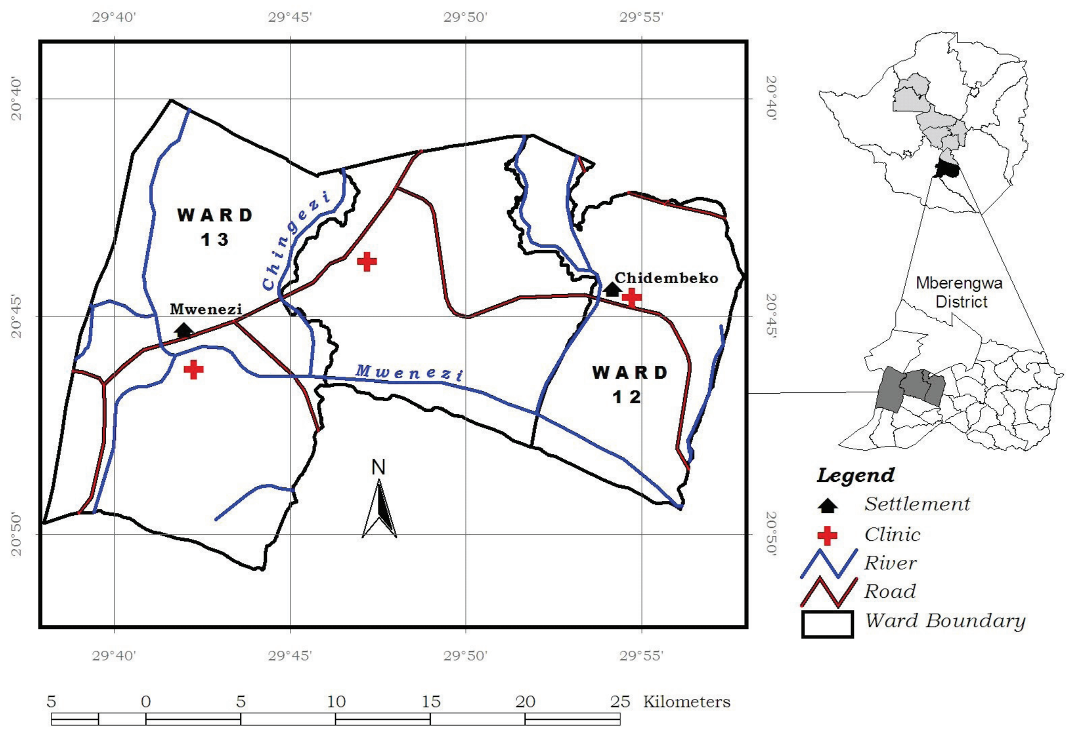

Figure 1

Methods and Materials

The collection of data was done through questionnaires and focus group discussions. A total of 79 questionnaires were administered, 45 in ward 12 and 34 in ward 13. One focus group discussion was conducted per ward to compliment information gathered using questionnaires. The questionnaires were administered to selected persons aged 20 and above. The minimum age limit of 20 years ensured that only respondents with a sound indigenous knowledge of the area, by virtue of their long stay in the area, participated in the study.

The questionnaire

The questionnaire sought to elicit information on the:

- villagers' perceptions on the accuracy levels of the indigenous weather forecasting systems in the area,.
- perceptions on levels of accuracy of weather forecasts from the Zimbabwe Meteorological department,
- accessibility of the meteorological weather forecasts to the residence of the two wards.
- comparison of the accuracy of the meteorological forecasts and the indigenous weather forecasts and
- recommendations from the locals on how to improve the indigenous and Meteorological weather forecasts.

Focus group discussions were conduct after the distribution of questionnaires in each of the two wards. One focus group discussion was conducted per ward. These discussions were aimed at assessing the residents' perceptions of the accuracy of the indigenous and meteorological weather forecasts. Responses regarding how accurate the residents perceived the meteorological forecasts were sought from only those who access this product. Recommendations on how both the indigenous and meteorological weather forecasts can be improved were also solicited from the group discussions.

Responses from the questionnaires and group discussions on how the locals rate the accuracy of the two forecasting systems were compiled into frequency tables. The same was done to assess the level of accessibility of the meteorological forecasts and the accuracy of indigenous weather forecasts. Percentage responses were then calculated and the results were presented as tables, pie charts, and graphs. Inferences were then made from these graphs, pie charts and tables.

Results and Discussion

Demographic Data of respondents.

Table 1 shows the demographic characteristics of the sample for wards 12 and 13. The total sample for the two wards was 70 respondents comprising 51 (64.5%) males and 28 (35.4%) females. The composition of the sample indicates that there were more males than females .This could be due to the patriarchal nature of the society where women are not free to interact with strangers.

Table 1: Distribution of respondents according to age group and gender

N =79	Ward 12 n=26	n=19	Ward 13 n=25	n=9
Age Group	Male	Female	Male	Female
20-30	11.5%	5.2%	12%	22%
31-40	15.3%	10.5%	20%	22%
41-50	15.3%	10.5%	24%	33
51-60	11.5%	52.6%	24%	0 %
61-70	23.07%	10.5%	8%	0 %
71-80	7.6%	5.2%	8%	11 %
Over 80	15.3%	5.2%	4%	11 %

Table 2: Period of Residence of Respondents according to gender

N=79

Period of residence	**Ward 12 n=26**	**n=19**	**Ward 13 n=25**	**n=9**
	Male	**Female**	**Male**	**Female**
20-30 years	15.3%	21%	8%	22%
31-40years	11.5%	15.7%	20%	22%
41-50years	11.5%	21%	12%	33%
51-60years	34.6%	26.3%	40%	0%
61-70years	7.6%	10.5%	8%	0%
71-80 years	7.6%	0%	8%	11%
Over 80 years	11.5%	5.2%	4%	11%

Table 2 shows the number of people who have resided in the ward for a given period. For example 15.3% males have resided in ward 12 for over 80 years and 52.6% females of the same ward have been resident for 51 -60 years. This could mean that most of the respondents had a good knowledge of the local environment and had the opportunity to use both forecast types. This then enabled them to assess the precision of these forecasts.

For both wards, 50.6% respondents have been resident in the area for 51 years and above. This implies that the information they gave was reliable and authentic. Males and females who participated are shown against their corresponding age groups.

Means of livelihood for the residents of wards 12 and 13.

Means of livelihood

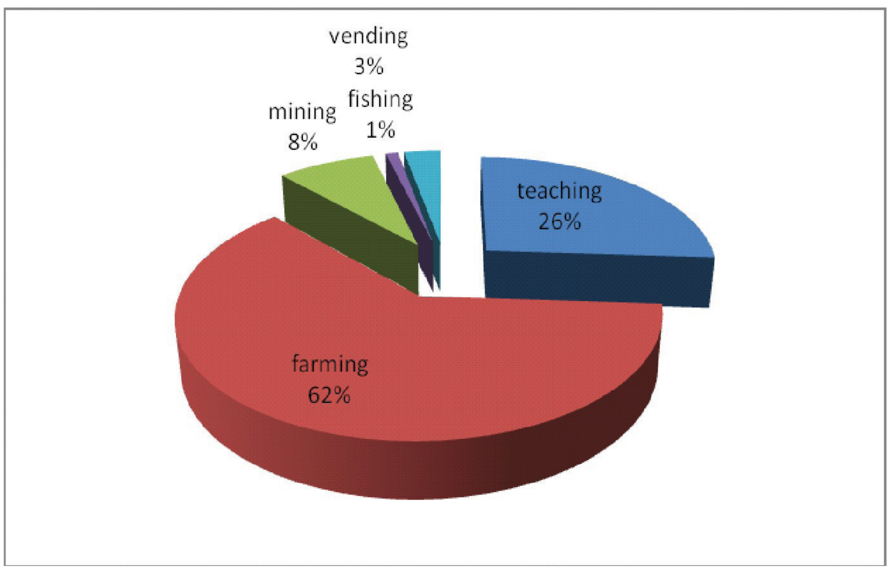

Figure 2

Figure 2 shows the distribution of the participants according to their means of livelihood.

The salient feature about Figure 2 is that 62 % of the respondents derive their livelihood from farming which in turn is directly affected by the weather. This implies that they should have a better understanding of indigenous forecasts that they use in their agricultural activities. 26 % are teachers who are better placed to interpret and assess the precision of meteorological forecasts as well as the indigenous forecasts.

Accessibility of meteorological weather forecasts to the residents of wards 12 and 13

Percentage levels of accessibility of Meteorological forecasts by residents.

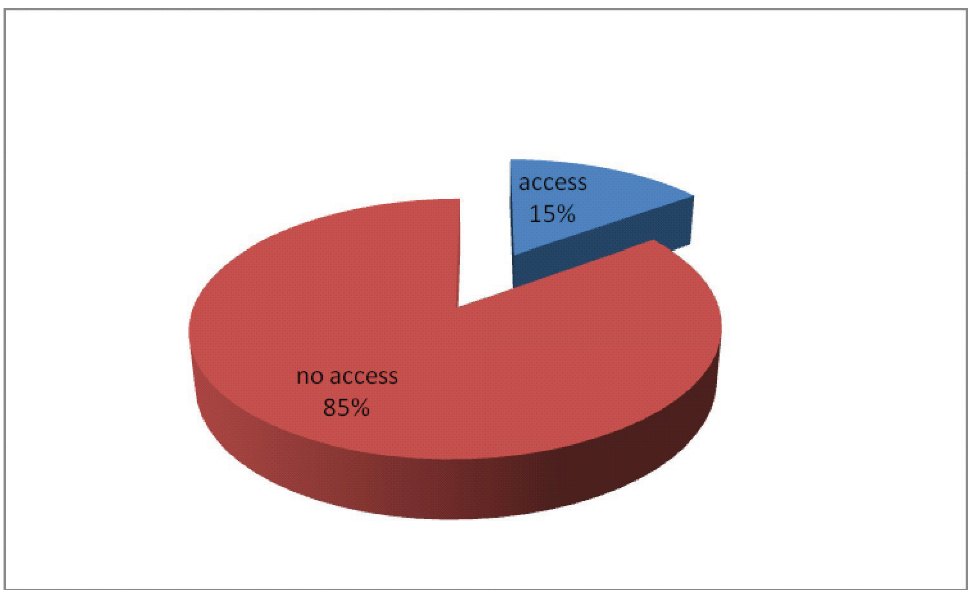

Figure 3:

Figure 3 show that 85% of the total sample indicated that they had access to meteorological forecasts and only 15 % said they had no access to these forecasts. This high rate of accessing meteorological forecasts should enable most respondents to compare the accuracy of the meteorological forecasts to indigenous weather forecasts.

Accuracy of indigenous weather forecasts

Ratings of the accuracy of indigenous weather Forecasts.

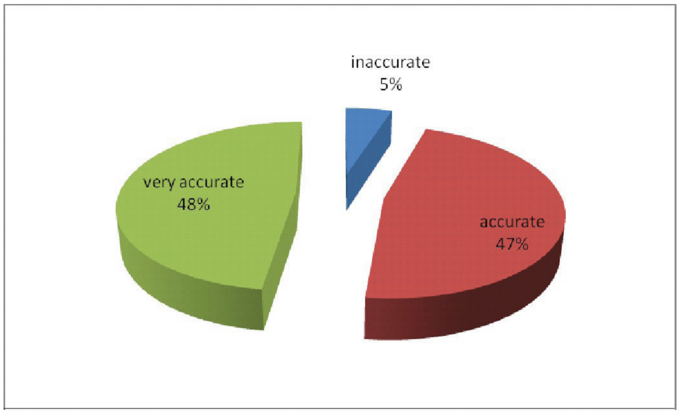

Figure 4

Figure 4 shows the responses on the accuracy of indegenous forecasts. A point to note from Figure 4 is that 5 % of the respondents indicated that the forecasts were inaccurate while 47 % and 48 % indicated that the forecasts were accurate and very accurate respectively. The accurate to very accurate category has a cumulative percentage frequency of 95 % which implies that residents of both wards 12 and 13 rate indigenous forecasts' accuracy very highly hence their reliability on them in agricultural decision-making processes.

Accuracy of Meteorological weather forecasts

Percentage ratings of accuracy of Meteorological forecasts.

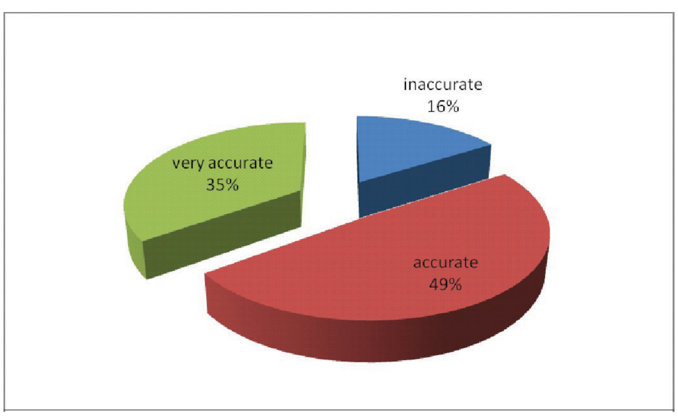

Figure 5

Figure 5 shows responses from those participants who had access to meteorological forecasts. The responses came from 85% of the total sample. Of interest from figure5 is that 16 % of the respondents rated the meteorological forecasts as poor compared to 5 % (see fig 4) who rated indigenous forecasts as poor. A cumulative 84 % rated the meteorological forecasts as accurate to very accurate. This means that meteorological weather forecasts are perceived by the residents as being accurate consequently the residents use them to compliment indigenous forecasts for agricultural planning purposes.

Comparison of the perceived accuracy levels of indigenous weather forecasts to meteorological weather forecasts.

Figure 6 indicates that 59 % of the respondents rated both forecasts as being the same while 32 % rated indigenous weather forecasts as better, only 9 % rated them poor. Those who rated the indigenous weather forecasts in the same to better category comprise 91%. Responses for the comparison of the two forecast types were elicited from only those with access to the two types of forecasts. These results indicate that both the indigenous weather forecasts and meteorological weather forecasts are precise and can play a significant role in weather sensitive decision-making for farming in the area. 32% of the respondents who access both forecasts clearly indicated that they perceived indigenous weather forecasts as having a higher level of accuracy than meteorological weather forecasts.

Percentage ratings of the accuracy indigenous weather forecasts against meteorological weather forecasts

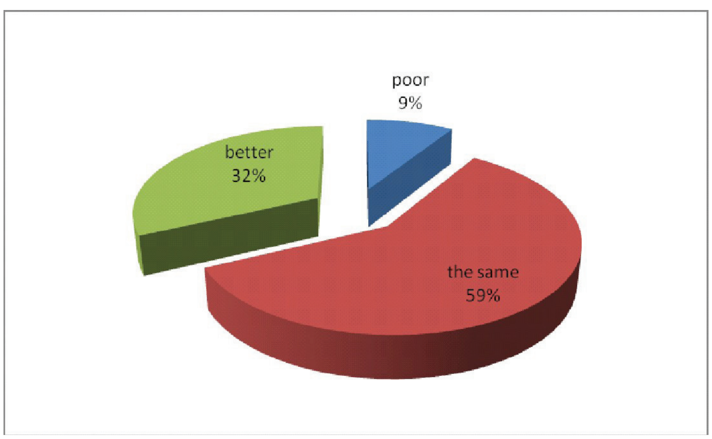

Figure 6

Precision ratings of indigenous weather forecasts from group discussions

Participants of the group discussions were asked to rate the accuracy of indigenous weather forecasts meteorological forecasts and their responses are shown on figures 7 and 8. Figure 7 shows that both wards place the precision of Indigenous weather forecasts on the good category with 62.5% and 65 % for ward 13 and ward 12 respectively. The residents value indigenous weather forecasts more than the meteorological weather forecasts. This could be attributed to the fact that meteorological weather forecasts are difficult to understand for the residents while indigenous weather forecasts are their own product.

Precision Ratings of Indigenous Weather Forecasts from focus group discussions

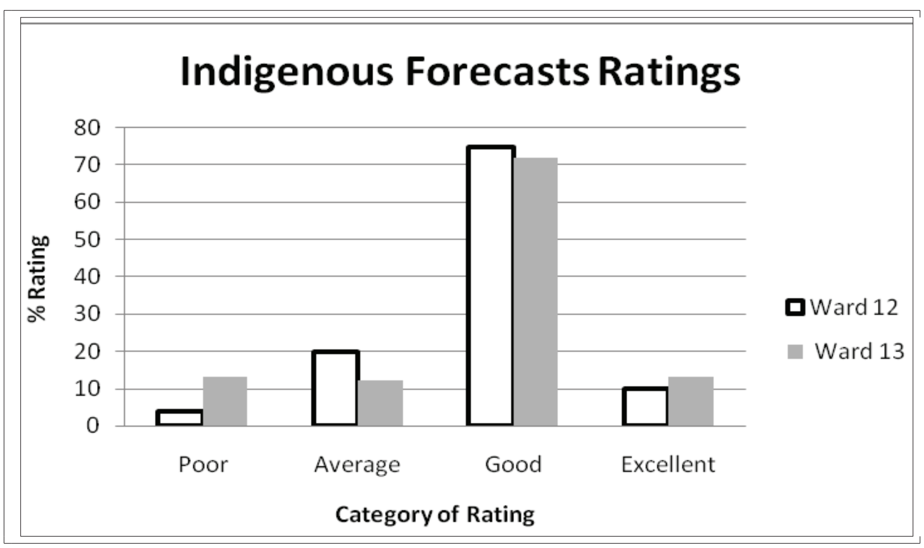

Figure 7

Precision ratings of meteorological weather forecasts from group discussions

Precision Ratings of Meteorological Weather Forecasts from group discussions

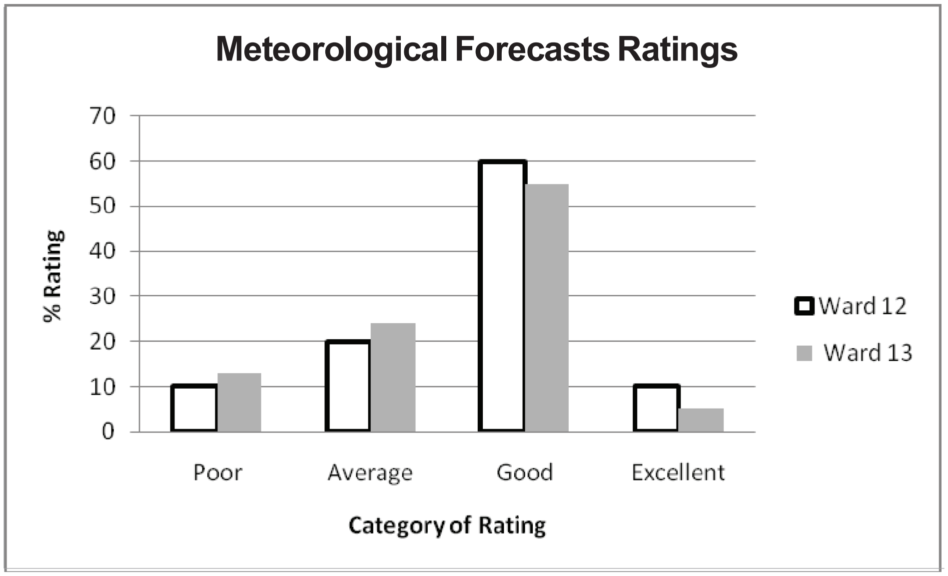

Figure 8

Figure 8 on the ratings of meteorological forecasts from group discussions shows that both wards rate these forecasts as good. The ratings are 60% and 56% for ward 12 and ward 13 respectively. So the residents value meteorological weather forecasts and can use them in their decision making processes.

The responses from both the questionnaires and the group discussion show that the residents of wards 12 and 13 view the two types of forecasts as being accurate and worth using in agricultural management plans. However, the same residents think that between the two forecasts, indigenous weather forecasts are more accurate than meteorological weather forecasts.

Recommendations

The findings from this research show that both indigenous weather forecasting systems and the meteorological weather forecasts are used because the residents value and trust these forecasts. This is clearly illustrated by the high accuracy ratings for both forecast types. The following recommendations were made from the findings to improve the accuracy and adoption rate of these forecasts:

- Synchronisation of the Indigenous weather systems (Iws) and the conventional Meteorological forecasts to come up with a product that is a hybrid of the two forecasting systems is essential to achieve higher levels of accuracy.

- The indigenous people should be given some education on what a weather forecast is, the terminology used for its dissemination, its benefits and its limitations. This will enable them to assess its accuracy.

- The national meteorological department should document the most important indigenous weather forecasting indicators in each of their forecasting zones and then use them when making weather forecasts.

- There is need to for a quantitative assessment of the precision of the indigenous weather as well as validating these forecasts.

- There is need to teach people how the Iws and Meteorological forecasts can be used for planning purposes. For example choice of a crop to grow that season and Irrigation scheduling. This should be done for both seasonal and short period forecasts, such as the daily weather forecasts.

- A comparative analysis of the precision of Indigenous weather forecasts and meteorological weather forecasts should be made annually by the Meteorological department and the local resident.

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