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Assessing indigenous knowledge systems and climate change adaptation strategies in agriculture: A case study of Chagaka Village, Chikhwawa, Southern Malawi

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ABSTRACT

In Malawi, production from subsistence rain fed agriculture is highly vulnerable to climate change and variability. In response to the adverse effects of climate change and variability, a National Adaptation Programme of Action is used as framework for implementing adaptation programmes. However, this framework puts limited significance on indigenous knowledge systems (IKS). In many parts of the world, IKS have shown potential in the development of locally relevant and therefore sustainable adaptation strategies. This study was aimed at assessing the role of IKS in adaptation to climate change and variability in the agricultural sector in a rural district of Chikhwawa, southern Malawi. The study used both qualitative data from focus group and key informant interviews and quantitative data from household interviews and secondary data to address the research objectives. The study established that the local communities are able to recognise the changes in their climate and local environment. Commonly mentioned indicators of changing climatic patterns included delayed and unpredictable onset of rainfall, declining rainfall trends, warming temperatures and increased frequency of prolonged dry spells. An analysis of empirical data corroborates the people's perception. In addition, the community is able to use their IKS to adapt their agricultural systems to partially offset the effects of climate change. Like vulnerability to climate change, IKS varies over a short spatial scale, providing locally relevant adaptation to impacts of climate change. This paper therefore advocates for the integration of IKS in programmes addressing adaptation to climate change and vulnerability. This will serve to ensure sustainable and relevant adaptation strategies.

1. Introduction

Agricultural production remains key to the national economies and people's livelihoods in Sub Saharan Africa. In Malawi, agriculture is the single most important sector, contributing about 33% to the Gross Domestic Product and 80% to national employment, with 90% of the labour force located in rural areas (NSO, 2009). However, the sector is highly vulnerable to the effects of climate change due to heavy reliance on rain fed agriculture. Climate change is defined as a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer (Trenberth et al., 2007). For Malawi, vulnerability and adaptation assessment reports for the years 2001, 2002 and 2010 (GoM, 2010) clearly indicate that the country is experiencing a variety of climatic hazards, which include intense rainfall, floods, seasonal droughts, multi-year droughts, dry spells, cold spells, strong winds, thunderstorms, landslides, hailstorms, mudslides and heat waves, among others. Recent climate trends assessments in Malawi show that the mean annual temperature increased by 0.9 °C between 1960 and 2006, with an average rate of 0.21 °C per decade. The frequency of cold days and nights has decreased significantly since 1960 in all seasons (McSweeney et al., 2008). These changes in climate are expected to continue to negatively affect on agriculture production across the continent, with small scale farmers being more vulnerable (Easterling et al., 2007), resulting in widespread poverty and food insecurity.

The Malawi Growth and Development Strategy II (MGDS II) recognises the risks of climate change to achieving sustainable economic growth in the country and adaptation programmes and projects are implemented under a framework outlined in a National Adaptation Plan of Action (NAPA). The IPCC defines

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adaptation as the, "adjustment in natural or human systems to a new or changing environment", in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Rural farming communities have over the years relied on indigenous knowledge systems (IKS) as a means of adapting to constantly varying and changing climate (Nyong et al., 2007). Indigenous or traditional knowledge refers to the knowledge and know-how accumulated across generations (Agrawal, 2003; IPCC, 2007). IKS have shown potential in development of locally relevant and sustainable adaptation strategies for adaptation to a variable climate in the agricultural sector (Watts, 1983; Richard, 1986; Chang'a et al., 2010; Adger et al., 2003; Guthiga and Newsham, 2011; Kalanda-Joshua et al., 2011; Joshua et al., 2012), mainly in the understanding of weather patterns through the use of natural indicators such as changes in the behaviour of local flora and fauna (DMCN, 2004; Kalanda-Joshua et al., 2011; LEAD-SEA, 2011).

This study was therefore based on the notion that incorporating indigenous knowledge into climate change policies and interventions can lead to the development of effective adaptation strategies that are cost effective, participatory, locally relevant and sustainable (Hunn 1993; Robinson and Herbert 2001). Nakashima et al. (2012) report that collaboration between indigenous knowledge holders and mainstream scientific research is generating new co-produced knowledge relevant for effective adaptation action at local level. This is because the knowledge is learned, identified and applied within farmer's cultural setting (Kalanda-Joshua et al., 2011). Since IK is site specific, it is essential to assess IK specific to a community in order to develop localised policies and intervention. Therefore, this study explored the role of IKS in agricultural adaptation to the impacts of climate change and variability. Specifically, the study (i) established climate change risks based on people's perception and empirical evidence, (ii) determined the impacts of climate change and variability on agriculture, and (iii) analyzed the significance of indigenous knowledge in climate change adaptation in agriculture.

2. Study area and methods

The study was conducted in Chagaka Village located in Mbewe Extension Planning Area, Chikhwawa district in Southern Malawi (Fig. 1). Chikhwawa district is located in lower Shire River flood plain. The area is prone to both drought and flood events. Annual rainfall ranges from 170 to 967 mm with a mean annual temperature of 37.6 °C (Joshua et al., 2011).

The study employed a combination of data collection methods for triangulation and validation. Qualitative data included documentation of traditional indicators used to predict weather patterns, people's perception of climate change, its impacts and adaptation strategies in the agricultural sector. The qualitative data were collected using key informant interviews and Focus Group Discussions (FGDs), held separately. A total of 10 key informants were selected taking into consideration the age of the individuals and the nature of their work in the village. The key informants comprised Agricultural Extension and Development Officers, Agricultural Extension and Development Coordinator, village headmen and selected elderly people with standing peerage.

The FGDs involved 15 and 20 purposely selected female and male participants, respectively, comprising of different groups of people such as boys and girls, men and women, the elderly and recent immigrants to the village. Three FGDs were conducted: Firstly, the male and female participants were separated into two gender distinct groups, while ensuring fair representation of the different groups of people, to get their observations on strategies, challenges and opportunities; Secondly, the male and female participants were mixed to get their observations on the same aspects. The gender based separation of the respondents into different groups was also meant to address cultural norms whereby the women may find it hard to express themselves in the presence of their husbands or village elders. At the time of the study, Chagaka Village had a total of 65 households. Out of the total households, 19 household respondents, comprising 12 and 7 male and female headed households, respectively, were randomly selected to participate in a household survey, representing 30% of the study population (Edriss, 2006). The interviews and FGDs were held around the three specific study objectives of (i) analysing farmers' perceptions of climate change and variability, (ii) significance of indigenous knowledge in climate change adaptation in agriculture and (iii) impact of climate change and variability on their agricultural production.

To validate the people's perception on climate change and variability, quantitative data were used. These were comprised of empirical rainfall and temperature data for the period 1971–2007 and were sourced from the Malawi Department of Meteorological Services and Climate Change and Illovo Sugar Company for Nchalo Weather Station (Fig. 1).

All collected qualitative data was thematically analysed, i.e. the data was categorised into major emerging themes. Quantitative data was analysed in excel and SPSS to produce summaries in graphs and frequencies/percentages. Rainfall and temperature data were standardised to get anomalies in order to establish annual variability and the trend in climatic variables, respectively. Linear regression was used quantify the slopes and direction of trends.

3. Results and discussions

3.1. Local communities perception of weather, climate change and climate variability

3.1.1. Traditional indicators for climate and weather prediction

People in Chagaka Village described the climate of their area as characterised by very high temperatures (slightly decreasing in May–July) and generally low rainfall with an erratic pattern. Rainfall is seasonal and is experienced during November–April. The farmers have historically utilised a variety of traditional indicators in making farm level decisions regarding farming systems such as crop choice and planting time. These indicators are based on cultural and traditional beliefs related to their perceived behaviour of the environment, animals such as birds and insects and tree species. Examples of tree species used in weather prediction include *Adonsonia digitata* (baobab/*mlambe*), *Cordyla africana* (*mtondo*), *Faidherbia albida* (*nsangu*) and *Mangifera indica* (mango). The shedding of leaves and the later production of flowers by these tree species than their usual time indicates drought. Table 1 provides a summary of the traditional indicators that the community uses to predict weather and climate and inform decision on farming activities. The main challenge in using these IKS indicators for weather prediction is the climatic change and environmental degradation since most of the natural prediction entities such as forest and wildlife which were abundant in the past are no longer available (LEAD SEA, 2011).

Furthermore, the respondents reported that a high occurrence of ants (locally called *Nyerere*) and termites (locally known as *Ngumbi*) indicates good amount of rains for planting crops. However, the occurrence of non-flying termites in a maize field indicates a prolonged dry spell. Consequently, farmers are unable to weed to avoid crop destruction by the termites. It was also reported that initially, the high temperatures between September and October indicated good rains. However, currently, a drought is expected. Similarly, a drought is expected when a bird locally

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