

Importance of Indigenous Knowledge in Agricultural as Means to Climate Change Adaptation in *Assalam* Locality, West Kordofan, Sudan

Mohammed Adam Abbas Hamad^{1,*}, Muneer Elyas Siddig Eltahir²

¹Department of Rural Extension and Social Development, University of Kordofan, Elobeid, Sudan

²Institute of Gum Arabic Research and Desertification Studies, University of Kordofan, Elobeid, Sudan

Email address

abugitaf2013@gmail.com (M. A. A. Hamad)

*Corresponding author

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Abstract

Climate change events affecting agricultural productivity through continues decline in crop yield in many vulnerable developing countries. This study was carried out in marginal village at *Alslam* locality, West Kordofan. The objective of this study was to identify and investigate the indigenous knowledge and practices of agrarian people in managing seasonal variability in the area and how they perceived it. Systematic random sampling technique was used where 68 respondents (representing 8% of the community) and (6) Focus Groups Discussions were done. Quantitative and qualitative data were obtained using in-depth interviews. The data fit to computer and Statistical Package for Social Sciences (SPSS version 16) was applied where descriptive analysis was done. Results revealed that the most indigenous practices by farmers were sowing in dry (*Ramail*), planting in different direction (*sherreik*), cropping pattern, change in crop variety (*Elkhifafa*), and diversifying income through off-farm activities. Farmers' perception towards crop productivity over the last three decades indicated that the majority of the farmers (89.7%), (80.9%) thought that rainfall pattern and crop productivity declined over the last decades respectively. Droughts represent the consequence effects of climate change in the area led to seasons failure. All (100%) farmers acquired their local knowledge and practices from their intimates and local environment. Finally, the study recommend for more attention to develop and encourage the effectiveness of the current practices and adjusting the "where, when, and how" to apply the recommended practices and to avoid the unsuitable ones by following enhanced resilience of agrarian people.

Keywords

Adaptation, Climate Change, Indigenous Knowledge, Kordofan, Sudan

1. Introduction

Indigenous knowledge (IK) generally refers to knowledge systems entrenched in the cultural customs of regional or local communities. Indigenous practices have been defined as experiments of original inhabitants, practices and representations maintained and developed by community with extended histories of interaction with the natural

environment [13] local communities have devised way and measures to maintain home-stasis and adapt to changes conditions. Studies suggest that scientists and practitioners agree in that local practices play a vital role in the development of any society. IK contrasts with the international knowledge system generated by universities, research institutions and private firms and includes diverse kinds of narratives or observations by an indigenous person or group. Since the 1980s, various kinds of IK have come to

be commonly accepted by scientists in the fields of agriculture [12]. Developing countries, especially Africa represent the worst hit and their poor people are the least capable of depending on themselves. This situation is attributed to the interaction of multiple pressure factors including; land degradation, desertification, decline runoff from water catchment, inadequate government mechanisms and lack of finance, low adaptive capacity due to factor such as extreme poverty, frequent natural disasters i.e. drought and floods [5]. The impact on each region depends mainly on the degree of vulnerability that natural ecosystems and human-made infrastructure have to changes in climate and extreme meteorological actions, as well as on the adaptation strategy toward new environmental circumstances [4]. People living in shortage of foods and margined area are more vulnerable to environmental changes conditions [10]. Rainfall is extremely important to agriculture particularly to those residing in rural area [6] therefore the impacts of climate change on agriculture are being witnessed all over the global but countries like Sudan are consider more vulnerable in view of the large portion of population reliant on agriculture and have poor coping mechanisms. Many studies have recorded phenotypic changes in natural populations and attributed them to climate change effects [7] so takes stock of current knowledge and practices of local communities for climate change represents response to this key problem affecting by environment events and assist economic development [15]. Indigenous knowledge of ecological zones, natural resources and conservations of natural resources in agriculture is far more sophisticated than followed by World Commission on environment previously assumed [14].

2. Objectives of the Study

The overall objective of this paper is to discover the indigenous knowledge and practices of smallholder farmers in study area in managing the climate change variability and impact. Specifically, to record and document local knowledge related to adaptation practicing of potential farmers in the area, to find out the perception of respondents toward climate change adaptation and to suggest recommendations for develop, promote, and protect indigenous knowledge in the area.

3. Research Methods

3.1. The Study Area

The greater Kordofan region lies between latitudes 9.5° and 16.4° Norths, and between longitudes 27° and 32° East with a total area of 380000 square Km. Rural populations represents 63%, the nomads 24% and only 13% are urban population. The annual rainfall in the region ranges between 200 mm in the north and 800 mm in the south. Millet, groundnuts, sesame and watermelon represent the most important agricultural crops grown in West Kordofan region,

in addition to gum Arabic and different types of livestock such as camels, cattle, sheep and goats [2].

3.2. Sample Selection and Data Collection

The targeted community was farmer's household in *Assalam* Locality. 8% from the total number of household (850) were selected. 68 farmers were selected randomly. The data was collected through face to face interviews (for households) using a questionnaire that was pre-tested and validated and focus group discussions for key informants. The questionnaire included questions about the farmers' socioeconomic characteristics and farming practices perception. Secondary data were collected from references and scientific journals. Frequency distribution and percentages were used to analyze the data using the Statistical Package for Social Science (SPSS) version 16.

4. Results and Discussion

The socioeconomic characteristics of studied respondents indicated high percentage (48.5%) of young age (≤ 40 years) compared to about (31.0%) of mature over 60 years. Young farmers in every developing country have been found to be more pioneering than their older counterparts (Rogers, 1993). On the other hand, it was found that (54.4%) of the respondents did not received formal education while (42.6%) of the respondents had small families of five or less members, only 17.6% of respondents had large families that consist of eleven or more members. As the family is the source of farm labor in this part of Sudan (West Kordofan). Farming system demands more labor, larger families are expected to be more innovative than small families. The vast of the farmers (45.6%) possessed medium size farms that range between 6 – 10 Mukhamas in size. Table 1.

Table 1. Frequency distribution of socioeconomic characteristics of the respondents.

Socioeconomic characteristic		Percentage
Age:	≤ 40	48.5
	41-60	31
	≥ 61	20.5
Years of formal education:	No formal education	54.4
	Primary education (1-4)	28
	Intermediate or higher education (≥ 5)	17.6
Family size:	Small family (≤ 5 members)	42.6
	Medium family (6-10 members)	39.71
	Large family (≥ 11 members)	17.6
Area of land owned:	Small farm (≤ 5)	29.4
	Medium farm (6 -10 Mukhamas)	45.6
	Large farm (≥ 11 Mukhamas)	25
Total		100

Results showed that the common indigenous practices of farmers in study area were; 1. Sowing in dry season which so called (*Ramail*). Farmer's conviction that each crop has appropriate planting date based on certain measure. Since ancient times some crop, millet in particular, is sowing in dry

i.e. before the one set of rain. Currently *ramail* is applied to other crop such as sorghum, sesame, and even ground nut. Crops other than millet are usually planted during the first week of July, during this period adequate rain are expected. Farmer tend to plant crops on dry to have the advantages of expected rain, however, such practice is risky. In other denote, if this rains is not sufficient enough for germination the planted seeds are exposed to rotting. 2. Planting in different direction; in place characterized by high variability of rainfall, farmers tend to plant in different directions known locally *sherreik*. Here farmer perceive that such practice reduce risk of planting ion one direction. 3. Crop prototype; farmer have abridged area under pearl millet and increased area under sorghum due to frequent failure of millet crop caused by variability of rainfall and pest infestation namely head warm *Nafasha*. Appearance of *Nafasha* is associated with existence of dry spells which has become more frequent for the last three decades. 4. Diverse in crop variety; Farmers change varieties of a given crop depending on the rainfall condition. Changes mainly concern a shift from long to short duration varieties (*Elkhifafa*). 5. Miscellaneous income through off-farm activities; Households diversify income from different sources particularly from off-farm activities. These include petty trading (charcoal selling), poultry production, and engaging in unskilled labor (migration to traditional gold mining). In the Americas, indigenous peoples rely on a diversity of crops, varieties and planting locations to cope with excessive or low rainfall, drought and other environmental changes. This serves as a safety measure which ensures that, in the face of severe environmental change, some crops survive [3] also in Sri Lanka farmers promotes the temporary redistribution of lands during drought periods as a means to share water resources therefore many indigenous peoples around the world rely on several local knowledge for adaptation, especially during times of environmental stress, which allow producing and exchanging resources So, The best guarantee for the survival of nature is the survival of indigenous ideas for those residing in the rural area [8].

Table 2. Frequency distribution of farmer's perception regarding rainfall pattern and crop productivity.

Farmers perception		Percentage
Crop productivity	Increased (last 5 years)	10.3
	Declined (last 5 years)	89.7
Rainfall:	Increased (last 5 years)	19.1
	Declined (last 5 years)	80.9
Total		100

Result extend to showed that "Table 2" farmers' perception of the trend in crop productivity over the last three decades indicate that a significant majority of the farmers (89.7%), (81%) report that rainfall and crop productivity have declined over the last decades respectively, and highlighted certain problematic climate-related events such as floods and

droughts. All (100%) farmers acquired their local knowledge from their intimates and local environment. As compared to outside knowledge, Indigenous knowledge has advantage of being cost effective, readily available and has been effective in solving problems regarding agricultural productivity of rural communities [14]. Also results depicted that vast respondents practices other activities beside farming to fill the shortage of income due to crop failure as successful alternative adaptation technique, however majority of those farmers look for their own practice have great positive affects in bridging the cap of climate change in last decade (82.4%) and only (39.7%) perceives their own practices have a little bit affect to cope with season variability. The importance of IK as stated by Murdoch and Clark [9] has a great role in sustainable agriculture development and global concern. Since IK is combined knowledge, it improves life of rural society through validated knowledge.

Table 3. The effect of practice indigenous agricultural knowledge in reducing crop losses due to seasonal variability in area.

The affects		Percentage
Positive affects	Extreme	47.1
	To some extend	35.3
	A little bit	17.6
Affectless	Extreme	19.1
	To some extent	41.2
	A little bit	39.7
Total		100

5. Conclusion and Recommendations

Results of the study showed that most farmers in the study area belonged to the relatively younger age less educated group with agriculture as the main source of income and livelihood. Smallholder's farmers have several indigenous knowledge and practices (adaptation strategies) to cope with climate variability and change which enable them to stay alive. Rural communities, particularly farmers perceived a decreasing trend of rainfall over years associated with a reduction in crop productivity, perceptions of seasonality and climate variability similar mainly according to ages and gender. Not every local knowledge is compatible with some of the tenets found in agriculture thereby is better harnessing the positive knowledge and provide a clear strategy. Developing Management of indigenous Knowledge plays a great role in agricultural sector whenever there is change in climate. This research work recommended encouraging effective indigenous knowledge and Build up of resilience and adaptive capacity in order to help vulnerable communities face the challenge and bridge the gap of climate variability and climate change. Strengthening networks, partnerships for climate technology transfer, working with national stakeholders to build or enhance indigenous capacities.

Table 4. Pair-wise ranking of indigenous practices.

	Type	1	2	3	4	5	6	Score	Ranking
A	Sowing in dry	E	B	B	B	D	B	6	2
B	Planting in different direction	A	E	A	E	B	E	5	3
C	Crop prototype	C	A	E	A	A	A	2	5
D	Diverse in crop variety			D	D	E	C	4	4
E	Miscellaneous income through off-farm activities						D	6+	1

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