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IMPACT OF WATER RESOURCES ON FOOD SECURITY IN ISLAMIC ECONOMICS: A CASE STUDY OF ADAMAWA STATE, NIGERIA.

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Abstract

The study examined the impact of water resources on food security in Islamic economics with the applications of structural equation model (SEM), in which seventeen (17) out of the twenty-one (21) Local Governments of Adamawa State were sampled based on the sample size developed by Sakaranj (2003). The findings of the study therefore, shows that, food availability, food stability, food accessibility, and food utilization which are the proxy to food security are significantly affected by water resources. The study recommends that water resources should be utilized in an Islamic economy in order to ensure food availability thereby resulting to food stability, food accessibility as well as food utilization and that government of an Islamic economy should make a provision for storing rainfall so as to improve and support irrigation farming to ensure food security.

Keywords: *Water Resources, Food Security, structural equation model (SEM)*

1. Introduction

Water plays a crucial role in the Islamic economy and is essential for food security. Zawran (2024) pointed out that, according to the principles of Islamic economics, it is incumbent upon us to conserve water and use it judiciously. In accordance with Sharia principles, fairness and equality is promoted in the distribution of water, protect critical resources, and advocate for better utilization. Measures for water conservation are extremely important. These include promoting water equity, harvesting rainwater and its better utilization, improving water distribution and usage in agricultural businesses, and safeguarding against artificial scarcity of water

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(Muhammad 2024). Similarly, standardized conservation measures for water are also part of the Islamic economy, such as preventing artificial obstructions and ensuring proper water purification.

Within the context of demographic growth, increased competition for water and improved attention to environmental issues, water for food remains a core issue that can no longer be tackled through a narrow sectoral approach. New forms of water management in agriculture, including rainfed and irrigated agriculture, watershed management, inland fisheries and aquaculture, and livestock and rangeland management need to be explored and implemented in a comprehensive way (Mark 2023). Farmers are at the centre of any process of change and need to be encouraged and guided, through appropriate incentives and governance practices, to conserve natural ecosystems and their biodiversity and minimize their negative impact, a goal that will only be achieved if the appropriate policies are in place. Irrigation institutions must respond to the needs of farmers, ensuring more and reliable delivery of water, increasing transparency in its management, and balancing efficiency and equity in access to water. This will require changes in attitudes but also well targeted investments in infrastructure modernization, institutional restructuring and upgrading of the technical capacities of farmers and water managers.

Water is essential for growing food; for household uses including drinking, cooking, and sanitation; as a critical input into industry, for tourism and cultural purposes; and in sustaining the earth's ecosystems. But this essential resource is under threat. Growing water scarcity in much of the world poses challenges for national and subnational governments and for individual water users. The challenges of water scarcity are compounded by soil degradation in irrigated areas, the increasing costs of developing new water, overpumping and depletion of groundwater, water pollution and degradation of water-related ecosystems, and the wasteful use of already developed supplies encouraged by subsidies and distorted incentives that influence water use (Rosegrant).

Growing water scarcity and water quality constraints are a major challenge to future food security, especially since agriculture is expected to remain the largest user of freshwater resources in all regions of the world for the foreseeable future despite rapidly growing industrial and domestic demand. As non-agricultural demand for water increases, water will be increasingly transferred from irrigation to other uses in many regions. In addition, the reliability of the agricultural water supply will decline without significant improvements in water management policies and investments. As such this study tends to investigates the effect of water resources on food security on the Islamic economic specifically Adamawa State, Nigeria. Therefore, the remaining sections of the paper are: Section 2 provides a literature review and theoretical framework. Section 3 discusses the methodology of the study where the data and the model are explained. While section 4 presents and discusses the estimation results, finally section 5 presented the conclusion of the study.

2. LITERATURE REVIEW

2.1 Theoretical Literature Review

The theory with which the study under investigation will be underpinned is the Ricardian Cross-Sectional theory developed by David Ricardo in 1815. However, the application of the theory to climate-land value is extensively realized from the work of Mendelsohn et al. (1994). The Ricardian Cross-Sectional theory assumed that climate has direct impacts on yields of different crops as well as the indirect substitution of different inputs, introduction of different activities, and other potential adaptation by farmers to different climates. The theory concern with how climate in different places affects the net revenue or value of land. Thus, the advantage and greatest strength of the theory over the remaining related theories: (the Production Function theory, the Agronomic-Economic theory, Agro-Ecological Zone theory) is its ability to incorporate the changes that farmers would make to reconcile their operations to climate change (Mendelsohn and Dinar, 1999).

The theory is therefore, adopted in this study due to the fact that, the theory explain that water resources directly affect crops yield which on the other hand, affect food security as it placed restrictions on the availability of food crops, consequently, accessibility to food crops, food utilization as well as food stability would be indirectly affected.

2.2 Empirical Literature Review

As water is an essential resource for growing food; for household uses in¬cluding drinking, cooking, and sanitation; as a critical in¬put into industry, for tourism and cultural purposes; and in sustaining the earth's ecosystems. But this essential resource is under threat. Growing water scarcity in much of the world poses challenges for national and subnational governments and for individual water us¬ers. The challenges of water scarcity are compounded by soil degrada¬tion in irrigated areas, the increasing costs of developing new water, over pumping and depletion of groundwater, water pollution and deg¬radation of water-related ecosystems, and the wasteful use of already developed supplies encouraged by subsidies and distorted incentives that influence water use. several studies have been conducted in order to investigate the magnitude of the effect and as well to comes out with the solution to the problem. Among these studies include the:

study of Ani, Anyika and Mutambara (2022) who examine the impact of climate change on food and human security in Nigeria, with the use of thematic content analysis. The result of the study shows that food security response negatively to climate change in Nigeria. According to the findings of study of Mirzaei, Kahrizi, and Hassan (2021) change significantly affects agricultural production and agricultural- related factors such as food security and economic well-being.

On the other hand, Atitsogbey Steniner-Asiedu and Ansong (2015) determined the impact of climate change on household food security in the Bongo district of the upper east region of Ghana. Mean and Standard deviation are adopted as technics of the study. The result of the study shows that household food security is significantly affected by the decrease in rainfall (-0.3) and increase in temperature (0.005 0_C).

Dinko, (2017) investigate Climate change and changing food security risk in Ghana. The findings of the study indicates that climate change have significant effect on Ghana food security. This is as a result of increase extreme weather condition.

The findings of the study conducted by Devendra (2012) who examined Climate Change Threats and Effects: Challenges for Agriculture and Food Security shows that the effects of climate change on agriculture and food security are mediated through heat stress and significant change in the quantity and quality of the feeds produced for use by animals.

On the other hand, Edame, Ekpenyong, Fonta and Duru (2011) analyzed Climate change, food security and Agricultural

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productivity in Africa. The finding of the study indicate that climate change is likely to reduce agricultural productivity, production stability and incomes in some areas that already have high levels of food insecurity. Whereas, Burke and Lobell (2010) determined Food Security and Adaptation to Climate Change: What Do We Know? The study discovered the evidence that wealthier and households have better chances for adapting to a changing climate because of their greater availability of alternative and their ability to take advantage of them.

3. METHODOLOGY

3.1 Research Design

The study under investigation is quantitatively design to examine the impact of water resources on food security in Adamawa State, Nigeria. The design on the other hand, is correlation in nature as it accounts for cause-effect nature of relationship between variables. Primary data was used and analyzed with the use of Structural Equation Model (SEM).

3.2 Method of Data Collection

The instruments that were used for collecting the data were questionnaires and interview in the selected local governments in the senatorial zone of Adamawa State.

3.3 Population of the Study

The population of the study will be all farmers heads, household heads, and whole sellers of Agricultural products specifically Rice and Maize which are the major dominant and consumable crops of the entire twenty-one (21) Local Governments of Adamawa State.

3.4 Sampling Techniques and Sample Population

seventeen (17) out of the twenty-one (21) Local Governments of Adamawa State will be sampled based on the sample size developed by Sakaranj (2003). From which farmers heads, household heads, and whole sellers of Agricultural products will further be sampled on the basis of random and systematic sampling. Hence, forty (40) questionnaires will be allocated and distributed to the relevant respondents of each sampled local government (i.e 17 LGA) and interview will be restricted to only farmers heads. In order to ensure reliability and accuracy of the data and to eliminate the chances of bias in the selection of the sample, percentage of local government in each senatorial zone is divided by the total number of local governments of the entire state (21) multiplied by the number of sampled Local Government (17):

Table 1: Sampling Procedure S/N	**Senatorial /Z**	**Total No. of LGAs**	**Sampled LGAs**	**No. of Respondents**
1	Central Zone	7	5	210
2	Southern Zone	9	7	280
3	Northern Zone	5	5	175
Total no. of sampled LGAs		**21**	**19**	**665**

3.5. Method of data Analysis

The techniques for data analysis is Structural Equation Model (SEM). it is a statistical technique developed for analyzing the inter-relationship among variables will be used in this study as presented below with respect to model specification and figure 1(Path Diagram) below:

3.6. *Model specification*

$Y^* = X^*\beta^* + \varepsilon^*$ ----------(1)

Where:

Y^*=Endogenous variables, which include: FAV, FST, FAC, and FUT

X^* = Exogenous variable (X1) which is WTR

FAV = Food Availability, FST = Food Stability, FAC = Food Accessibility, FUT = Food Utilization, and WTR = Water Resources

The Structural Equation Model (SEM) can therefore be expressed further as:

$Y = X1\beta1 + X1\beta2 + X1\beta3 + X1\beta4 + \varepsilon1 + \varepsilon2 + \varepsilon3 + \varepsilon4$ ---------- (2)

4. RESULTS AND DISCUSSION

4.1 Measurement Model

The FAV= (food availability), FST=(food stability), FAC=(food accessibility), FUT=(food utilization), are used as a dependent variables, whereas, WTR=(Water Resources) is the independent variables. As such, four (4) relevant questions for each variable under the study were theoretically raised to stand for a latent construct of the food availability, food stability, food accessibility, food utilization and water Resource. However, the latent constructs satisfied the series of pre-estimation test of model fitness, reliability and validity as shown in Table 4.5. The entire factor loadings are significantly higher than 0.6. This shows that all the factor loadings are within the acceptable range based on the decision rule.

4.2 Structural Model

The structural models in regard to this study are first of all subjected to the stated hypotheses.

Base on the objectives of the study which were subjected to the stated hypothesis above, Structural Equation Model (SEM) is introduced as shown in Figure 1 in order to determine whether null hypothesis statement would be accepted or not.

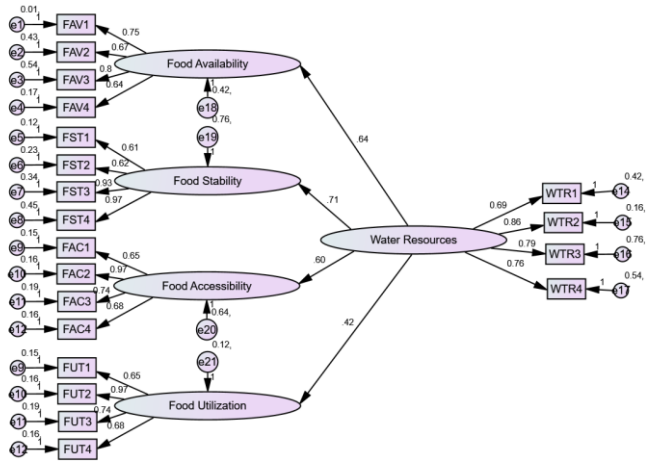

Figure 1

Figure 1 shows that food availability, food stability, food accessibility, and food utilization which are the proxy to food security are significantly affected by water resources. Hence, Figure 1 also confirm the reliability of the latent variables for each of the latent construct. The value of the parameter estimate of

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water resources to food availability is 0.64. that is, I unit increase in water resources, food availability increases by 64%. This implies that water resources significantly affect food availability. Consequently, Food Stability, Food Accessibility, and Food Utilization, significantly affected. Based on the finding of the study due to increase in food availability caused by increase in water resources, food stability, food accessibility, and food utilization increases by 71%, 60% and 42%. It has been observed from the result of the study that, food stability carries high magnitude of the effect of water resources than that of food stability and food utilization.

This implies that, increase in water resources contributes significantly to the food security, consequently, individuals will have access to food due to its stability thereby leading to the present of nutritional well-being. The present study finding is similar to the following previous study findings: Ani, Anyika and Mutambara (2022), Mirzaei, Kahrizi, and Hassan (2021), Atitsogbey Steniner-Asiedu and Ansong (2015).

5. Conclusion

The study investigates the impact of water resources on food security in Islamic economics: A case study of Adamawa state, Nigeria. Primary data were considered with the given sample size of 665. The study on the other hand, employed Structural Equation Model to analyze the data. Based on the findings of the study, it has been conclude that, increase in water resources contributes significantly to the food security, consequently, individuals will have access to food due to its stability thereby leading to the present of nutritional well-being.

6. Recommendations

The following recommendations were made on the bases of the findings of the study:

i. The study recommends that water resources should be utilized in an Islamic economy in order to ensure food availability thereby resulting to food stability, food accessibility as well as food utilization.

ii. The study also recommends that government of an Islamic economy should make a provision for storing rainfall so as to improve and support irrigation farming to ensure food security.

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