EFFECT OF FLOOD DISASTER ON THE FOOD SECURITY STATUS OF CASSAVA FARMERS IN KOGI STATE, NIGERIA: EMERGING ISSUES FOR THE POST 2015 UNIVERSAL SUSTAINABLE DEVELOPMENT AGENDA

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The flood disaster which ravaged Kogi State in 2012, left in its trails, colossal devastation, including destruction of farm houses, farmlands, crops, livestock, and other personal effects, with associated displacements, culminating in food shortages, human morbidity and mortality, amongst others. This study therefore examined the: food security status of the respondents; determined the effect of the flood disaster on the food security status of cassava farmers and identified the coping strategies used by respondents to cushion the effect of the flood. The study used cross-sectional data covering 120 respondents; quasi-experimental design, food security index, double differencing estimates, Tobit model and t- test of significance to achieve the objectives of the study. The results revealed that food insecurity increased by 12.5% amongst the flood affected cassava farmers compared to a decrease of 21% within the control group. The double differencing estimate of -1.3 further confirmed that the flood disaster had a negative effect on the flood affected farmers. However, the t-test of significance established that any difference in the food security status of the two populations at 5% probability level could only have been due to chance. The Tobit regression results further affirmed the absence of a causal link between the flood disaster and respondents' food security status at 5% probability level, probably, due to the short term nature of the incident, customary coping strategies adopted, prompt response by the governments and development partners. In spite of these efforts, but considering the magnitude of food insecurity established, there is the need to critically review the food security situation in the state and align the food security strategic plans and objectives to the national and global frameworks, particularly, those bordering on Sustainable Development Goals 2 (zero hunger) and 13 (climate concerns) respectively, with the view to achieving an enduring and sustainable food security for its over 3 million population, within the context of the Universal Sustainable Development Agenda.

Keywords: *Climate Change, Flood, Food Security, Sustainable Development Goals.*

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INTRODUCTION

In recent times, food security threats have been of concern in many developing countries, including Nigeria, given the climate-dependent nature of the agricultural systems and weak mitigation and coping capabilities (Bello *et al*., 2012).Thus, the effects of climate change have been documented in several literature to be associated with numerous disturbing scenarios, including drought, flood, high level disease and pest infestations, leading to poor crop growth, low productivity, output, food insecurity and eventually poverty (Bello, 2012; Adejuwon, 2004; Zoellick and Robert, 2009; Schmidhuber, *et al*., 2007; Parry *et al.,*1999). According to the Inter Governmental Panel on Climate Change (IPCC) (2014), the negative impact of climate change on crop yields have been more prevalent than the positive impact. Schmidhuber *et al., (2007)* established that between 5 million and 170 million additional people are at risk of hunger by 2080, while Parry *et al*., (1999) put it at between 70 and 90 million within same period. In Nigeria, the 2012 flood which ravaged numerous states, including Kogi, impacted negatively on various areas of the Nigerian economy (National Emergency Management Agency, 2012). The disaster was not unconnected to excessive rainfall within the country, as well as water released from Lagdo reservoir in Cameroun. According to Action Aid (2006), floods are mainly due to the effect of large volume of rainfall which causes a rise in the water level of a river. IPCC (2014) noted that when climate-related hazards impact the poor, it manifest in the areas of livelihoods, dwindling crop yields, or destruction of homes and indirectly, through increased food prices and food insecurity. In extreme cases, floods have been associated with loss of lives, over-flooding of river banks and washing away of economic crops, trees and livestock (Adeleye and Rustum, 2011). Many food security researchers have argued that modern agriculture demands a sustainable and environmentally production system if it were to unlock its economic, environmental, social and cultural benefits. Flooding has been known to cause great impact on the physical and socio-economic system of modern agriculture within the intervening domain. The 2014 IPCC report also alluded to the effect of flood on human socio-economic activities, food security and poverty. This study therefore answered the following research questions: what is the effect of flood on the food security status of affected cassava farmers?; what were the strategies adopted by the affected farmers in coping with the disaster?. The broad objective of the study was to ascertain the causal linkage between the 2012 flood on the food security of cassava farmers in Kogi State. The specific objectives were to: determine the food security status of the respondents; ascertain the effect of the flood on the food security of the respondents; and determine the coping strategies adopted by affected farmers to cushion the effect of the flood disaster. The justification for the study stems from the need to have a deep understanding of the dynamics of the economic effect of flood on the food security of cassava farmers and its implication on the Global Sustainable Development Goals (SDGs). The study will also be beneficial to the various stakeholders in the agriculture sector in the State, particularly, the government, farmers and other private sector operators.

REVIEW OF LITERATURE: CLIMATE CHANGE, FOOD INSECURITY AND SUSTAINABLE DEVELOPMENT GOALS

Climatic change refers to an alteration in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014). The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, referred to climate change as: "a change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."Wikipedia encyclopaedia (2010) further posited that climate is the long-term pattern of weather in a particular area. It is measured by assessing the patterns of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods of time. Bello *et al*., (2014) hinted that climate change is one of the environmental life-threatening variables to economic development and sustainability of man-kind worldwide. Numerous researchers have argued that the problems of climate change are global in nature and that developing countries, particularly Africa will be mostly affected (Parry *et al*,.1999). Climate change, thus has the likelihood of increasing flood risk significantly and progressively over time. Bradshaw *et al*.,(2012) further established that rising level of atmospheric carbon dioxide can cause a rise in sea level and flooding.

Floods are mainly sudden and unpredictable. Aside these, they may only last a short-while, but their economic effect are devastating if mismanaged. According to Action Aid (2006), flood has been one of the major factors hindering the African continent from escaping poverty and by extension, food security. Effects of flood on the socio-economic lives of humans include destruction of economic crops, washing away of homes and generally food insecurity. Floods have been categorized in various ways according to the magnitude, intensity and duration. Bariweni *et al.*, (2012) categorized flood into six groups, namely (i) tidal flood; (ii) fluvial flood; (iii) flash flood; (iv) groundwater flood; (v) pluvial flood; (vi) flood from sewer; and flood from man-made infrastructure. Floods have been noted to be due to several factors, such as heavy rainfall, severe wind over water, unusual high tide, failure of dam, retention ponds (Halley, 2001) and also by human action, as was also partly the case with the 2012 flood in Nigeria. Research has shown that cassava was the second most affected crop in the 2012 flood experienced in Nigeria (Sidi, 2012).

The 1996 World Food Summit held in Rome, Italy agreed that 'Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle.' Following up logically, the Federal Ministry of Agriculture and Water Resources (2008) posited that food insecurity exists when an individual or group of people are undernourished as a result of the physical unavailability of food, lack of access to, and/or inability to use food effectively due to infection or disease. The source noted the wide range of factors that place people at risk of becoming food-insecure, from unrestrained population growth, climatic factors to political instability. Food and Agriculture Organization (2010) noted that153 States ratified the International Covenant on Economic, Social and Cultural Rights (ICESCR) and thus have an obligation to progressively realize the right to adequate food. This is not unconnected to the visible evidence of food insecurity across the globe. National Planning Commission (2001) established evidence of national food production failure to keep pace with the population growth and the decline in per-capital terms, despite various efforts by government to stimulate food production. Shittu (2015) revealed that 62 percent of Nigerians live on less than $1.25 per day, 55 percent is under-nourished while the country ranks 14.8 on Global Hunger Index (GHI), even though, trend analysis established decline in hunger levels.

Shittu (2015) referred to the SDGs as proposed set of development objectives and targets relating to future international development. The SDGs built on the Millennium Development Goals (MDGs) which expired at the close of 2015 and was perceived of being too narrow and exclusionary. The SDGs were adopted by the UN summit in September 2015 and became globally applicable in January 2016. The SDGs contains 17 Goals and 169 targets, covering a wide range of development issues, ranging from zero poverty and hunger, improving health and education, making cities more sustainable, combating climate change, protecting the environment, among others. The focus on hunger (Goal 2) is to ensure access by all people, in particular, the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round; achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and addressing the nutritional needs of adolescent girls, pregnant and lactating women, and older persons. The emphasis under climate change (Goal 13) relates to strengthening resilience and adaptive capacity to climate related hazards and natural disasters in all countries; integrating climate change measures into national policies, strategies, and planning; promoting innovation and infrastructure, ensuring sustainable cities and communities, improving education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.

Conceptual Framework

The conceptual framework in figure 1 depicts the relationship between climate as proxied by flood and food security status of the respondents in survey. The flow is such that with the interaction of climate (intervening variable) on the production variables of the cassava farmers may draw both positive and negative outcomes, but mainly with respect to the latter, given the severity of the flood. The framework therefore details the dependent and independent variables, intervening factors, assumptions and the resulting effect and impact. Ekong (2013) noted that conceptual representations are robust system of explanations rooted largely on tested and improved assumptions of realities.

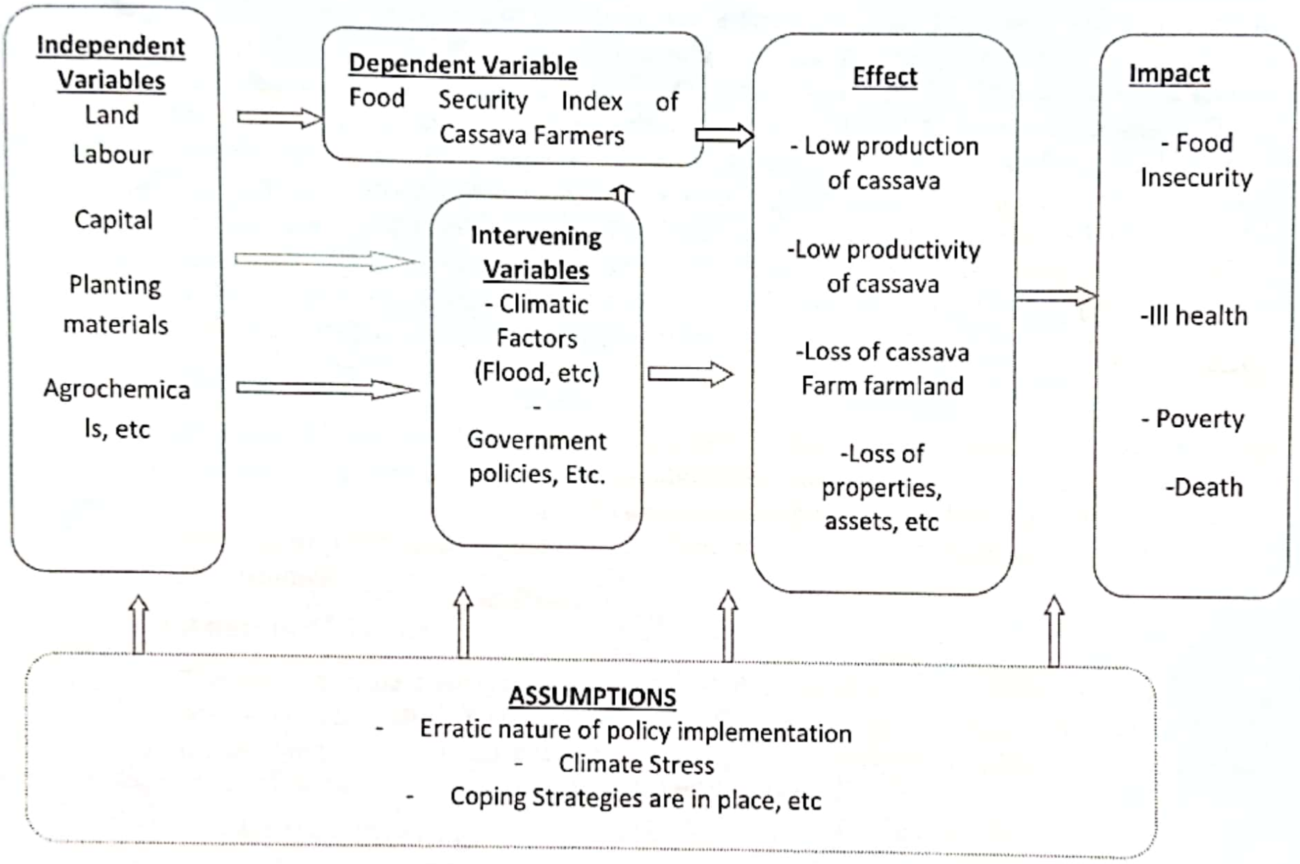

Figure 1: Causal Linkage of Flood and Food Security Status of Cassava Farmers

3.0 RESEARCH METHODOLOGY

The study was undertaken in Kogi State, in the North Central of Nigeria. It lies within Latitude 7°30N′and Longitude 6°42′ E. The State has a land area of 1,498 km^{2}and an estimated population of 3,314,043 (National Population Commission (NPC), 2011), which is put at about 3,658,083 as at 2015, using a population growth rate of 2.5%. Estimated average annual rainfall is put at 1,231 mm, mean and average high temperatures are 22.1° and 32.7°C respectively. This gives an annual average temperature of 27.4° C (Climate Nigeria, 2014). Its vegetation falls within the northern guinea savannah, while rainfall supports growth of cereals, legumes and root crops.

Sampling Techniques and Sample Size

To achieve the objectives of the study, multi-stage sampling procedure was employed to collect data from the flood affected farmers and the control. The first stage involved a random selection of Kogi State from the 27 States affected by the flood disaster, the second stage covered the simple random selection of eight Local Government Areas (LGAs), namely Dekina, Omala, Ankpa, Bassa, Kogi, Lokoja, Koton Karfi and Ibaji; made up of 5 LGAs from the flood affected areas and 3, from the non-flood affected areas. The third stage of sampling was the selection of 29 villages from the population. The last stage was the selection of 71 flood affected and 49 non-flood affected cassava farmers using a random technique at 5% level of precision and 95% confidence interval.. The unequal distribution reflects the differing population of respondents within the sampling frame.

Data Collection

The data for the study were obtained through well-structured questionnaire and covered respondents' production, income, expenditure data and other specific, and socio-economic related characteristics of respondents under the two population. Data were collected through the use of experienced Enumerators from the Kogi State Agricultural Development Programmed.

Analytical Techniques

The method of data analysis involved the derivation of a relative food security index, a counterfactual analysis covering the flood affected and control group, involving a double differencing approach and a Tobit binary regression analysis, employed to ascertain the effect of flood on the food security status of the respondents.

Model Specification

Relative Food Security Index (FSI)

The FSI was employed to determine the food security status of the respondents (Flood affected and non-flood affected farmers). The model is specified as follows:

$$Fi = \frac{\text{Per Capita Food Expenditure for the ith Household}}{\text{2/3 Mean Per Capita Food Expenditure of all Households}} \quad (1)$$

Where Fi = Food Security Index

When $Fi \geq 1$ = Food Secured ith Household

$Fi < 1$ = Food Insecure ith Household

Double Difference Model

This is a quantitative method used to estimate and compare change in outcome (food security status) pre and post occurrence for flood affected and non-flood affected cassava farmers (Chen *et al.*, 2006). The model is specified as follows:

$$DD = \left[\frac{1}{P}\sum_{i=1}^{P}\left(Y_{1\,ia} - Y_{1\,ib}\right)\right] - \left[\frac{1}{C}\sum_{j=1}^{C}\left(Y_{0\,ja} - Y_{0\,jb}\right)\right] \text{---------- (2)}$$

Where:

DD = outcome difference between the respondents;

P = number of flood affected farmers (affected);

C = number of non-flood affected farmers (control group);

$Y_{1\,ia}$ = number of flood affected farmers after the flood;

$Y_{1\,ib}$ = number of flood affected farmers before the flood;

Y_{0ja} = number of non-flood affected farmers after the flood;

$Y_{0\,jb}$ = number of non-flood affected farmers before the flood.

Test of Hypotheses

The estimation of the significant difference between the food security status of the flood affected and the non-flood affected farmers was tested using paired samples t-test specified as:

$$t_{cal} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}}} \text{.. (3)}$$

Where,

$\bar{x}_1$ = the mean food security index of flood affected farmers

$\bar{x}_2$= the mean food security index of the non-flood affected farmers

δ_1^2 = standard deviation of variable for flood affected farmers.

δ_2^2= standard deviation of variable for non-flood affected farmers.

n_1 = number of flood affected farmers

n_2 = number of non-flood affected farmers

Tobit Regression Model

The Tobit model was used to determine the effect of flood on the food security status of the flood affected farmers. The empirical Tobit model is explicitly specified as:

$Y^* = \beta_o + \beta_1 CRED + \beta_2 HHSize + \beta_3 LAN + \beta_4 LAB + \beta_5 PLTMAT + \beta_6 FLDSTAT + e$

Where,

$Y^* = 0$, If the household food security index is less 0 or less than 1 and $Y^* = 1$, where food security index is 1 or greater than 1.

CRED = Credit received by household (Naira)

HHSize = Household Size (Number)

LAN = Land (Hectares)

LAB = Labour used (Man-days)

PLTMAT = Planting Materials (Bundles)

FLDSTAT = Flood Status of Respondents (Flood Affected =1; Non Flood Affected = 0).

e = error term

β_0 = Intercept estimated

$\beta_0 - \beta_6$ = Coefficients estimated

4.0 FINDINGS AND DISCUSSION OF RESULTS

The results of the relative food security analysis are shown in Table 1.0. The analysis revealed that 23% of the flood affected farmers were food in-secured before the flood disaster compared to 29% under control. Following the flood disaster, the flood affected farmers witnessed an increase of 12.5% (from 16 to 18 households) in the numbers of non-food secured population compared to a decrease of - 21% (from 14 to 11 households) obtained under the control population. The implication of this finding is that food insecurity situation increased amongst the flood affected households after the flood incidence. The incidence of food insecurity is not uncommon within the Nigerian terrain as researchers like Orewa and Iyangbe (2009) and Ibrahim *et al.,* (2009) have all reported cases of food insecurity arising from social, physical and environmental intervening variables associated with the farming households.

Table 1.0: Food Security Status of Respondents

Food Security Status	Flood Affected				Non-flood Affected			
	Before	%	After	%	Before	%	After	%
Food un-secured	16	22.5	18	25.4	14	28.6	11	22.4
Food secured	55	77.5	53	74.6	35	71.4	38	77.6
Respondents	71				49			

Source: Field Survey, 2014

Table 2.0 represents the outcome of the double differencing analysis covering the effect of the flood incidence on the food security status of the respondents. The results showed that there was a decrease in the food security status of the flood affected cassava farmers as indicated by a double differencing (DD) value of -1.3. This implies that the flood disaster had a negative effect on the food security status of the flood affected cassava farmers. However, the results of the t- test undertaken to ascertain the significant difference between the food security indexes obtained from the two populations indicated that there were no significant difference between the food security statuses of the two populations at 5% probability level and that, any observed difference must have been probably due to chance. In general, the outcome of this study aligns closely with the findings of Okwoche and Asogwa (2012) in their analysis of food security situation among Nigerian rural farmers, who established that that 30% of the sampled population were food in-secured. The result is however contrary to the findings of researchers like Ajani *et al.,* (2006); Akarue and Bakporhe (2013) and Adeniyi and Ojo (2013) who established that most of respondents under study were food in-secured. The result under the study, though contrary to expectations, but may not have been unconnected to the short duration of the disaster, use of customary coping mechanisms by respondents, and probably, prompt intervention and support for affected cassava farmers by governments and development partners.

Table 2.0: Results of the Double Differencing (Effect) Analysis

Food Security Status	Flood Affected		Non-flood Affected	
	Before	After	Before	After
Summation of Food Security Index	125.8	124.6	60.3	60.4
Difference	-1.2		0.1	
Double Differencing (Effect)	-1.3			
Respondents	71		49	

Source: Field Survey, 2014

The output from the Tobit analysis (Table 3) revealed that flood had no significant effect on the food security status of the respondents in survey as indicated by a z- value of -1.67. This results runs contrary to the findings of Emaziye *et al.,* (2012), Schmidhuber *et al.,*(2007) and Parry *et al.,(*1999) who established relations between climate change and food security. This result may probably be due to the short term influence of the flood disaster, even though harvests and assets, such as lands, homes and other tangible properties were lost in the incident. However, variables such as credit and labour were significant at 5% probability levels, implying that these were factors which could have been relevant in explaining the food security status of the respondents rather than the flood incident.

Table 3: Tobit Regression Analysis Results on the Effect of Flood on Food Security Status of Respondents

Variable	Coefficient	Std Error	z-test
Constant	0.9051774	1.49	0.61
Credit	0.9279714	0.435508	2.31
Household Size	-0.0642886	0.0719037	-0.89
Land	-0.0079771	0.336586	-0.24
Labour	4.98E-06	2.15E-06	2.32
Planting Material	3.44E-06	3.06E-06	1.12
Flood Status	-0.8099194	0.4856358	-1.67
Log likelihood	-114.24		
No of Observations	120		
LR Chi2	16.02		
Prob.>Chi2	0.0136		
Pseudo R^2	0.0655		

Source: Analyzed results from field survey data (2014)

Table 4.0 shows the coping strategies adopted by the flood affected farmers after the flood disaster. The table revealed that most of the flood affected cassava farmers relied on multiple measures in coping with the effect of the flood. Majority (85.92%) adopted multiple farming systems, while substantial numbers too relied relatives and on government support. The adoption of these coping strategies must have probably limited the adverse effect of the flood disaster on the cassava farmers. Okwoche and Asogwa (2012) established that majority of the respondents relied on intercropping as a way out of food stress in the study area. However, much depends on the affected cassava farmers to urgently review their life styles and production practices with a view to effectively coping with future occurrences of climatic challenges, such as flood.

Table 4: Coping Strategies Adopted by Respondents After Flood Disaster

Coping Strategies	Frequency	%
Adoption of New Farming Systems	61	85.92
Government Donations	36	50.07
Support from Relatives	43	60.56
Foreign Organizations and NGOs	30	42.25
Personal Savings	40	56.34
Total	210*	

Source: Field survey, 2013

*Multiple responses

Emerging issues and action points for the achievement of the SDGs in Kogi State, especially as it relates to Goals 2 and 13, should be directed at increasing investment in support of ending hunger, through monetary and fiscal means; ensure holistic and effective alignment to the existing national food security policy, support rural infrastructure development, agricultural research and extension services, ensure regular and bio-technology development integration into the food security strategy, amongst others. Shittu, (2015) noted the need to strengthen resilience and adaptive capacity to climate related hazards and natural disasters, integrate climate change measures into national policies, strategies, and planning; improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning. The urgent need to raise capacities for effective climate change related planning and management, including focusing on the marginalized groups, particularly women and youth have also become imperative if the State is to achieve the global sustainable development goals and targets.

5.0 CONCLUSION AND RECOMMENDATIONS

Arising from the outcome of the study, it is evident that in relative terms, substantial numbers of the respondents are still food in-secured. However, it was established that the 2012 flood disaster had no causal link with the food security in the study area, implying that the disaster had no significant effect on the food security status of the affected farmers, probably due to the short duration of the disaster, adoption of traditional coping strategies and prompt intervention of government and development agencies. However, to achieve zero hunger and poverty in the light of the current global SDGs and adequately redress the climate concerns, the study recommends the following: (i) the need to re-align the state's development planning framework with the national and global SDGs; (ii) effectively and holistically ensure the implementation of the national food security strategies; (iii) strengthen farmers coping and resilience capacities through encouraging the development of climatic information sharing and mitigation groups; (iv) institutionalization of awareness campaigns geared towards re-orientating the flood affected cassava farmers on sustainable environmental management and diversification practices.

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