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Verifying the Relevance of a Vulnerability to Food Insecurity Index in Practice for Households in South Nigeria

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Abstract

This paper examined the relevance of the Vulnerability to Food Insecurity Index (VFII) in practice for households in South- South region of Nigeria. The main objectives were to verify the result of the VFII with real life experience and to under- stand why households are vulnerable to food insecurity using qualitative insight. The paper applied both quantitative and qualitative methods. The main findings reveal that the indictors of the index were able to reflect real-life experiences on the ground. However, applying the index to local community requires greater consideration of the heterogeneous population and relative importance of indicators. Thus flexible weight system is recommended when the index depends on local conditions.

Keywords: Food security; vulnerability; social indices; validity; Nigeria

Introduction

Vulnerability has been extensively explored as a theoretical construct with a range of definitions and therefore, it can be challenging to identify an appropriate set of indicators to measure vulnerability without being specific about the sector, system, goal, and scale (Hinkel, 2011). There are multiple approaches within the literature used to operationalize the concept of vulner- ability. This is because of the need to improve assessments that help target support to those who are most vulnerable, and the increasing demand by policymakers for decision making (Eriksen & Kelly, 2007; Himes-Cornell et al., 2016; Zurovec et al., 2017). Operationalizing the concept into practical methodologies remains a contemporary challenge, particularly in the area of food security (Ibok et al., 2019).

Conventional approaches to vulnerability assessment are based on outcome and context. The outcome approach considers how a system might be vulnerable as a result of natural hazards. It is therefore focused on how the biophysical condition of a system affects its vulnerability, for example, climate change risk. The difficulty in applying this approach to the concept of food security is that it ignores social, economic, political, and cultural factors (Fellmann, 2012; T. T. Nguyen et al., 2016). Using a contextual approach is more helpful in the context of food security because it considers vulnerability in a more holistic manner, allowing an analysis of the influence of biophysical, social, political, economic processes and structural aspects on people's food security. Unlike the outcome approach, the contextual approach also considers the sensitivity and adaptive capacity of a system (T. T. Nguyen et al., 2016). This makes the outcome approach widely adaptable in operationalizing vulnerability and causing a significant shift in the debate from physical vulnerability to social vulnerability (Cutter et al., 2003).

One important methodology used to operationalize vulnerability in social science is the construction of indices (Krishnamurthy et al., 2014; C. V. Nguyen et al., 2017), for example, the use of the livelihood vulnerability index (Adu et al., 2018). Currently, social vulnerability indices are under intense criticism because of lack of ground-truth evidence to validate the quantitative analysis (Himes- Cornell et al., 2016; Maguire, 2015). There is a risk that policy decisions about long-term initiatives to enhance food security in a vulnerable population may otherwise not be effective or have unintended consequences. According to Himes-Cornell et al. (2016), the goal of decision-making using vulnerability indices should be to create a reliable and appropriate policy, and this will only be delivered when measurement and reality on the ground are consistent.

This paper responds to this challenge by using ground-truth evidence to verify a Vulnerability to Food Insecurity Index (VFII). The VFII is a multidimensional food security indicator that measures household food vulnerability (Ibok et al., 2019). Food vulnerability is defined as a situation that occurs when food-related shocks cause households to be vulnerable to food insecurity (Lovendal & Knowles, 2005). A VFII was developed to improve on traditional food security indicators which are not sufficient to address the challenges posed by multiple risk factors that affect household food vulnerability (Ibok et al., 2019; Nagoda, 2015). Innovative approaches and methodologies are urgently needed to address the risks of pockets of food insecurity at the local level and to support national planning. Supporting food security nationally will help in securing the agenda of global food insecurity embedded within the Sustainable Development Goals (FAO, IFAD, UNICEF, WFP & WHO, 2017; UNDP, 2015). Barrett and Palm (2016) assert that an unacceptably large proportion of people globally continue to suffer from chronic or transitory food insecurity. FAO, IFAD, UNICEF, WFP & WHO (2017) estimate that the number of undernourished people globally has increased from 777 million in 2015 to 815 million in 2016. The VFII developed in Ibok et al. (2019) can be applied to locations where there is a need to better understand the patterns of rising food insecurity and poverty, and for this paper, the case study of Nigeria is used. According to FAO (2015), the number of undernourished people in Nigeria increased from 10 million in 2010 to 13 million in 2012. Currently, Nigeria has the highest rate of poverty in the world with 87 million people living in extreme poverty (Crespo Cuaresma et al., 2018).

The main objective of this paper is to use ground-truth evidence to verify VFII index results using empirical data from Nigeria. Specifically, the paper will verify whether the indicators used in the VFII are relevant and how divergent the results are from the ground-truth experience. This process will identify how robust and reliable the index is, and offer important reflections on the potential value of using ground-truth evidence in index construction.

To contextualize the importance of this research paper, a short review of the relevant literature follows in section 2. The methodology used is then outlined in section 3, and in section 4 the results are presented. A discussion of the implications of these results is given in section 5 followed by the conclusion.

The value of identifying reliable vulnerability indexes for practice

The development of improved vulnerability indexes for food security is becoming increasingly important within social science research, particularly for the international development agenda. The focus of this development is to identify a reliable index that uses a multi-dimensional assessment approach to support decision making for policy makers and

practitioners (Chen et al., 2018; Tandon et al., 2017). Vulnerability indexes are used to identify the cause of vulnerability and explain the attributes of a vulnerable system (Füssel, 2010). In the context of food security, vulnerability indexes are used primarily to target intervention to food-poor households, thereby reducing the underlying cause of vulnerability and strengthening households' abilities to confront stressors (Ribot, 2017). Irrespective of the relevance of vulnerability indexes, there remain a gap in the knowledge about how these approaches using quantitative indexes compare to the reality on the ground (Barrett & Palm, 2016; Hinkel, 2011; Nagoda, 2015; Nazari et al., 2015; C. V. Nguyen et al., 2017). Scholars have consistently called for the development of a vulnerability index that relates the theoretical construct of a multidimensional understanding of vulnerability to food insecurity to pragmatic assessments that are reliable on the ground (Himes-Cornell et al., 2016). Using qualitative methods to verify the quantitative results of an index is useful in achieving this (Meenar, 2017; Perez-Escamilla et al., 2017). According to Neset et al. (2018), after evaluating the role of indicators to assess agricultural vulnerability to climate change, it is important to integrate both qualitative and quantitative data approaches in the final design of a vulnerability index. However, there is little in the methodological literature that reports ways of performing this stage of verification. Himes-Cornell et al. (2016) therefore call for a more effective way of testing for an index's validity and suggest comparing the convergence of the qualitative data with the rankings of the quantitative data. They suggest that a quantitative index that shows a high correlation with the qualitative ground-truth evidence is likely to be best oriented toward reality on the ground and therefore most reliable for practice.

This gap in understanding arises because of important challenges. The first is that the term "vulnerability measurement" itself remains conceptually debated. Hinkel (2011) argues that vulnerability is not an observable phenomenon, and therefore cannot be measured. Instead, he argues that the term "vulnerability measurement" should be replaced with the term "operationalizing vulnerability." Despite this, Nelson et al. (2016), De Grosbois and Plummer (2015), Zurovec et al. (2017), and Bayes and Kelman (2018) have produced a range of methodologies for measuring vulnerability. This debate highlights the value of this paper in contributing to the development of approaches to operationalizing vulnerability through more effective assessment tools.

An additional challenge is that there is a serious lack of good quality data for use in vulnerability index analyses. According to De Grosbois and Plummer (2015), data used to design vulnerability indices are often inadequate. This encourages the use of different approaches and methodologies to deal with this challenge. For example, two common approaches are (a) the data-driven or inductive approach, which lacks theoretical insight during indicator selection, and (b) the theory-driven or deductive approach, which does not aggregate data for composite indices in constructing a vulnerability index (Vincent & Cull, 2014).

Developing indicators when using poor quality data may result in the vulnerability index representing an inaccurate scenario of differential food insecurity at the ground level (Neset et al., 2018; Vincent & Cull, 2014; Wiréhn et al., 2017). According to Vincent and Cull (2014), vulnerability is multi- dimensional, and it is impossible for vulnerability indices to represent the different drivers and interaction of current vulnerability experiences in practice. Vulnerability indices may only present a snapshot of the current condition of a system being measured. Fellmann (2012) labels this snapshot as "static vulnerability". Therefore, vulnerability indices represent current conditions but do not provide guidance on future

conditions. However, the principal objective of vulnerability analysis is to show changes from an inter-temporal dimension. This is because a household that is vulnerable today, may not remain in the same condition forever, and over time may be able to secure its livelihood and food security. This means that vulnerability index assessments should be accompanied by evidence from ground-truth case studies and be subjected to regular testing and refinement to ensure they are a robust assessment tool (Malone & Engle, 2011; Vincent & Cull, 2014). Ribot (2017) emphasizes that vulnerability index assessment is the first step in the process of vulnerability assessment and policy development. This is important because vulnerability and its causes are diverse, yet vulnerability assessment tools are often not able to deal with local-level differentiation and the specific problems found in different locations.

The development of vulnerability assessment tools must be accompanied by empirical ground-truth case studies to convince policymakers and practitioners of the relevance of a tool and inform them of the local interpretation needed to ensure the approach is useful for reducing vulnerability in a particular context. Incorporating information from case studies adopts a place-based approach to vulnerability assessment which is otherwise missing, and allows consideration of peoples' social, cultural, and production systems, accounting for the specific risks they face within the community. Therefore, while a vulnerability index can inform decision-makers about patterns for the general population to be targeted, case studies generate insights that help with effective interpretation and implementation. The few examples of this approach include a method by Bayes and Kelman (2018), who designed an index for measuring vulnerability to environmental hazard in Bangladesh, using both quantitative modelling and insights from a qualitative case study.

To consolidate this approach and manage the disparity between quantitative index results and the reality on the ground, increasingly the focus in the literature is to provide evidence of best practice. Providing a robust methodology that includes an evaluation of index validity and reliability using a qualitative case study methodology is accepted as the best way to show the validity of an index (Vincent & Cull, 2014). This approach still requires a clear conceptual framework, stating the assumptions and sources of data to avoid the criticism of manipulation (De Grosbois & Plummer, 2015). Furthermore, it is important to explain how vulnerability indicators link to reality on the ground (Eriksen & Kelly, 2007; Wiréhn et al., 2017). Finally, it is clear that vulnerability assessment is most valuable when it is place-based, considers multiple interacting stressors and examines the differential adaptive capacity of those affected by food insecurity. Managing the limitations of a vulnerability index continues to be challenging, and users of the results obtained by this method should be aware that they show only a snapshot of the present conditions. Thus, interpretation of the policy or practice responses depends on their trust in the tool and their understanding of the assumptions and implications (C. V. Nguyen et al., 2017).

Methodology

This section presents a summary of the quantitative procedure used to design the VFII and the qualitative case study, including the study site selection, sampling, and tools. Details of the quantitative methods written in this section can be found in Ibok et al. (2019) which is the parent paper.

Quantitative methods used to design a vulnerability to food insecurity index

Firstly, a conceptual framework for vulnerability to food insecurity was developed, including the three main components of exposure, sensitivity, and adaptive capacity (Ibok et al., 2019). The VFII was applied to household data from the South-South region of Nigeria, covering the states of Edo, Bayelsa, Akwa Ibom, Cross River, Rivers, and Delta. This data was publicly accessible from the World Bank and the first phase of the Nigerian Living Standard Measurement Survey was used in designing the index (World-Bank & NBS, 2014, 2015). Particular indicators and variables were selected to represent each of the core components of vulnerability, as shown in Table 1.

Subsequently, these variables were normalized to ease comparison and for all variables to have an equal unit similar to the reasons in OECD (2008). The variables were normalized using the min-max method based on the recommendation from the sensitivity and uncertainty analysis carried out in Ibok et al. (2019). The min-max normalization method used is presented in Figure 1:

$$I_{q,c} = \frac{X_{q,c} - min(x_q)}{\text{Range } (x_q)} \quad (1)$$

Where $I_{q,c}$ is the normalized value of each variable x_q, $x_{q,c}$ is the raw value of individual variables, *min(*xq) is the minimum value for each variable and *range* x_q is the difference between the maximum and minimum value of the variable x_q.

The third step involved applying weight to these variables. Equal weight was applied to each component of VFII. This means that each component was given the same weight of 0.33, implying that all have the same "worth" for the index. However, within each component of the VFII, variables had different weight depending on the total numbers of variables. For instance, in the Adaptive Capacity component, each variable had a weight of 0.0412; while in the Sensitivity components all variables had the weight of 0.11, and the Exposure component variable had the weight of 0.33 (Ibok et al., 2019). Equal weight was adopted for the index after performing a robustness check com- paring the effect of different weight and equal weight using a sensitivity and uncertainty analysis (Ibok et al., 2019). The sensitivity analysis showed that applying equal weight to the VFII produced a robust output compared to using different weight generated from a principal component analysis (PCA). Moreover, variables in the VFII were grouped into three components, the component with a larger number of variables would have a higher weight if different weight was applied. Considering that the exposure component after final computation had only a single variable as a result of lack of data, this would result in an unbalanced structure of the VFII if the PCA weight was adopted. Apart from equal and unequal weight, this research did not explore weight from expert opinion because of constraints in the availability of experts during the field work.
Finally, the linear aggregation method, shown in equation 2, was used to generate the VFII score (OECD, 2008).

$$VFII_i = \Sigma AC_i - (\Sigma E_i \, \Sigma S_i) \quad (2)$$

The VFII categorized households into three different food vulnerability groups based on the score. These groups represent households highly vulner- able to food insecurity, mildly vulnerable and not vulnerable. The more positive the VFII score, the less households are vulnerable to food insecurity and vice versa (Ibok et al., 2019).

Qualitative methods: ground-truth procedure

Selection of location

The quantitative results from the VFII analysis were used to produce a vulnerability to food insecurity map for the sample households in the South- South region of Nigeria, as shown in Figure 1. This map ranked the six states according to their VFII composite score. The state that is ranked first has the smallest number of food vulnerable households while the state that is ranked sixth has the highest number of food vulnerable households. The map was used to purposely select Akwa Ibom State for the ground-truth data collection and verification exercise. This was because the researchers were not granted ethical clearance approval to Bayelsa because of safety reason based on FCO recommendation.

Secondary data collection and key informant interviews with the Akwa Ibom State Agricultural Development Programme (AKADEP) and the Ministry of Agriculture and Food Sufficiency, Akwa Ibom State (MOA) were conducted in the state. Key informants indicated communities that are vulner- able to food insecurity and a scoping visit identified two communities, Ibesikpo Asutan and Ikono, to illustrate an urban and a rural context, respectively.

Sampling within the community

In each community, a focus group discussion was conducted with a range of locally-important stakeholders, including the village head and village council members, to obtain permission and necessary community information. This information included mapping of community resources, understanding the food-related shocks that had affected the community within the past four years, characterizing households based on local wealth ranking, their coping strategies, and validation of the VFII indicators.

Participatory exercises, such as resource mapping, wealth ranking and proportional pilling (WFP, 2001) were used during the focus group discussions to capture community resources and to generate local perception that was used to classify households into categories of highly vulnerable, mildly vulnerable, and not vulnerable to food insecurity. The information from the focus group discussions also enabled a comparison of the VFII indicators with local perception. Stakeholders were asked to identify what characterizes household food insecurity and vulnerability and these local perceptions served as indicators to identify households that were within each of the 3 categories of food insecurity and vulnerability (Table 2).
Using a local guide and two research assistants, households were selected for in-depth interviews using the local perceptions of highly vulnerable, mildly vulnerable and not vulnerable to food insecurity established in the focus group discussions. A snowball sampling technique was used to identify fifteen house- holds from each community, generating a total of 30 households in the ground-truth case study (see Table 3). Based on the three-food insecurity and vulnerability groups, five households were interviewed within each group. During the household in-depth interviews, a short participatory exercise of matrix ranking was conducted. Interviews were conducted with the household head or a member of the household who was knowledgeable regarding food security, although other household members were present and willingly contributed to the discussion. The interview focused on questions about the impact of food-related shocks on households or other factors hindering access to adequate food, household response, formal food support programs available, and perceptions of the agricultural season calendar. Questions were constructed to ensure that interviewees were not led to particular answers and the process was subjected to the necessary ethical procedures. Qualitative data generated were analysed using a thematic

coding process to identify important local indicators of vulnerability to food insecurity, the relative importance of these indicators as perceived by the group, and whether these indicators were different by locational context. Also, these data provided insight into the perceptions of the different groups and contexts of the indicators used in the VFII.

Results

This section is organized according to the three components of the VFII to allow presentation of each stage and a comparison of local perceptions from the ground-truth evidence with the VFII indicators.

Results from the VFII showing the prevalence of shocks according to food vulnerability group and context at the macro level

Results from the VFII quantitative analysis were compared with the qualitative analysis from the ground-truth data. The prevalence of shocks for households in Akwa Ibom State is shown in Figure 2. The analysis shows that in the urban area job loss (25%) and theft (25%) were the most prevalent shocks that affected household vulnerability to food insecurity in 2011. However, about 50% of households in the urban area did not experience these shocks. In the rural area, theft (40%) and job loss (20%) were the most prevalent shocks to vulnerability of food insecurity. The rural area had more food-related shocks that affected vulnerability to food insecurity than the urban area in Akwa Ibom State. These shocks included flooding that caused harvest failure (10%), illness of the breadwinner (10%), and poor rainfall that caused harvest failure (10%). About 10% of households in the rural area were not affected by these shocks. Overall, job loss and theft were the shocks with the highest prevalence that affected vulnerability to food insecurity in Akwa Ibom State.

Table 4 presents the prevalence of food-related shocks by context and VFII groups for all sample households. The results show that kidnapping is only typical for households in urban areas, although this is a very low percentage. Table 4 also shows that in both the urban and rural communities, high food prices and theft are the shocks with the highest prevalence. Specifically, households in the rural community that are highly vulnerable to food insecurity were commonly affected by theft (28.26%), illness (23.6%), and high food price (17.7%), while high food price (39.1%), job loss (30.08%), and theft (23.3%) were shocks that mostly affect households in the urban community (Table 4). However, for mildly vulnerable households, those in the rural community were mostly affected by theft (27.14%), illness (21.43%), and high food price (18.57%) while those in the urban community were most affected by high food price (73.91%), theft (17.39%), and kidnapping (4.35%). Households that were not vulnerable to food insecurity, 45.65% of these households were not affected by any shocks in the rural community while 52.7% of households were not also affected by any shocks in the urban community. However, for those households that were affected and were classified as not vulnerable to food insecurity, poor rain (14.49%), theft (14.49%) and high food price (14.49%) were the shocks with the highest prevalence in the rural community while high food price (28.38%), poor rain (12.16%), and theft (6.76%) were the shocks with highest prevalence for household in the urban community. Overall, for households in the rural community, theft, high food price, and illness were the shocks with the highest prevalence while, high food price, job loss, and theft were the shocks with the highest prevalence in the urban community (Table 4).

Comparing the relative importance of VFII indicators at the community level

The focus group discussions involved community leaders, such as the village head, religious and youth leaders, and teachers. During these discussions, respondents were asked to collectively rank the VFII indicators according to their perceived level of importance except for shocks indicators. However, for shocks, the respondent was rather asked to identify variables with the most significant impact on household vulnerability to food insecurity and allocate scores. A shock with the highest score represents the most severe. The discussion for this section is presented according to the three components of the VFII.

For the exposure component, "unemployment" and "flooding that caused harvest failure" were perceived as the most severe shocks that significantly influence household vulnerability to food insecurity in the Urban community. Similarly, in the rural community, high food price was perceived as the most severe shock that affected household vulnerability to food insecurity (as shown in Table 5). The important fact from the focus group discussion is that, stakeholders in the community ranked shocks according to the perception of their relative importance and effect on food system in the community. Subsequently, shocks like "high food price", "poor rain that causes harvest failure", "unemployment" and "flooding that cause harvest failure" were perceived as the most severe shocks that influence household vulnerability to food insecurity in the rural community, reflecting that the primary source of livelihood is from agriculture. Meanwhile, the urban community perceived "unemployment" and "flooding that cause harvest failure" as the most severe shock that influences household vulnerability to food insecurity. This reflected the urban nature of the community setting, where livelihoods were more diversified with less reliance on agrarian activities.

For adaptive capacity, the indicators perceived to have the highest impact on household ability to cope with food insecurity in the rural community are "availability of good roads", "water sources", "provision of good housing structure", and "sustainable income from jobs". Availability of good roads was accorded the highest priority as an adaptive capacity indicator in the rural area. This reflects local concern for transporting perishable farm produce to the market and the reliance on farming income as the primary source of livelihood. In the urban community, "education", "income from non-farm enterprise", and "water source" were perceived as the most important adaptive capacity indicators affecting household ability to cope with food vulnerability.

Finally, Table 5 also shows how stakeholders perceived the importance of the sensitivity indicators of the VFII. Child mortality was given the highest relevance and became the most severe effect of accumulative experience of food insecurity for households in the urban community while starvation (hunger) was the most severe effect of accumulative experience of food insecurity in the rural community. Child mortality was important as most households could not afford the cost of hospital bills and resorted to using various native delivery methods. Also, in the rural community, stunting was the next indicator that had severe effect on households as a result of accumulative experience of food insecurity while starvation (hunger) was the next sensitivity indicator that influence households vulnerability to food insecurity.

Comparison of the prevalence of shock from the field work (ground-truth data) with the result of VFII

The sample households listed all natural, social, political, health, and economic shocks perceived to have affected their food insecurity over the last five years. The five most

important shocks were then ranked according to their severity and impact on household food insecurity. This section identifies which significant shocks are perceived to cause household vulnerability to food insecurity. The results are organized by the three food vulnerability groups and by sector.

Comparing the prevalence of shocks for urban and rural community using evidence from fieldwork (ground-truth data) and VFII result

The results in Table 6 show household perception in the urban location of the prevalence of shocks at the community level within Akwa Ibom State, Nigeria. These perceptions (Tables 6 & 7) are compared with the VFII results at the state level (Table 4).

Households in the urban community were mostly affected by theft, job loss, and high food price (Table 6). Households that are highly vulnerable to food insecurity, identified job loss and high food price as the most prevalent shocks that affected their vulnerability to food insecurity. Mildly vulnerable households were influenced by theft and job loss. Households that were not vulnerable to food insecurity reported their experience differently because they were indirectly affected by shocks. For example, a private primary school owner experienced a reduction in income because of the job losses of pupils' parents, which affected their ability to pay tuition fees. Therefore, the shocks experienced by households that were not vulnerable to food insecurity were indirectly theft and job loss. Compared to rural community the result in Table 7 shows the perception of the prevalence of shocks at the community level for sample in the study area. The most prevalence shocks reported by rural households during the ground-truthing exercise were broader than those reported by urban households. More shocks were perceived as highly prevalent in the rural community compared to the urban community. High food price, theft, job loss, illness, and poor rainfall were the shocks with the highest perception of prevalence for households in the rural community. Highly vulnerable households were most affected by high food price, which had a negative impact on vulnerability to food insecurity. The shocks that affected mildly vulnerable households were theft and illness, while households that were not vulnerable to food insecurity were affected by theft and poor rainfall.

Furthermore, comparing the perceptions of households in the urban locations (Table 6) with the VFII result in Table 4 shows that the same shocks were reported by households at both community and state level to be important in characterizing vulnerability to food insecurity (Table 6). For example, the VFII results show that urban households are affected by high food price, job loss, and theft. These were the same shocks reported by households during the ground-truth exercise. However, moving from the state level to the community level, the level of prevalence was not comparable. Theft was perceived as the shock with the highest prevalence for urban communities during the fieldwork, while high food price was the shock with the highest prevalence using the VFII constructed at the state level. For rural location, the same shocks that affect households at state level was perceived to affect households at community level – when comparing the VFII results in Table 4 with the ground-truth data in Table 7. However, the level of prevalence did differ when comparing the findings of VFII with the result from the fieldwork. From our VFII result in Table 4, "job loss" and "theft" were the shocks with the highest prevalence for households in the rural community. From the fieldwork, "high food price" was the shock with the highest prevalence for households in rural community (Table 7).

A comparison of the coping strategies of urban and rural households with the adaptive capacity component of the VFII

Data about perceptions of how households cope with vulnerability to food insecurity was collected, and this was restricted to information about the period of food shortage, response to lack of food, formal food assistance, and other support available, and locations where households particularly needed support. Table 8 show illustrative comments about coping strategies adopted by households. Households that are highly and mildly vulnerable to food insecurity in the urban and rural community employed severe coping strategy like reducing consumption when faced with food shortage. Coping strategies used by urban households that are not vulnerable to food insecurity were least severe. They were able to diversify their livelihood activities using their extra assets and capacity and, in doing so, reduced the risk of food insecurity. In contrast, the same group of households in the rural community commonly use a mildly severe coping strategy, such as hawking food in the street. This suggests that households in the rural community have weaker coping abilities to recover from food shortage compared to households in the urban community.

The analysis did not directly compare the coping strategies used at the community level with the adaptive capacity component in the VFII because the latter uses indicators that identify long-term measures of vulnerability to food insecurity reduction, while the coping strategies identified by the communities were short-term measures. Rather, the comments from the ground- truth exercise provided data that can be used to make inferences about the state of households' assets, livelihoods and entitlements.

To improve households' adaptive capacity, the following areas were reported during ground-truth exercise as a priority: jobs for unemployed youths, high quality, and affordable education, improved means of livelihoods, such as access to quality fertile land, housing, electricity, and increments in salary proportional to the current inflation rate. All these priorities reported by households were already included in either the exposure or adaptive capacity component of the VFII as specific indicators. This further confirms the relevance of the VFII indicators to adequately capture vulnerability to food insecurity.

There was no formal social aid available to households in the study area. During the ground-truth exercise, the community leader complained about a lack of regulation and the role of the market in exacerbating vulnerability to food insecurity and highlighted examples of a high tax on the poor, difficulties in managing microcredit and even fraudulent organizations. "No organisation has come in to help the community in terms offering food support. Rather the community has fallen into fraudulent hands. People come in to help, promising to empower households, but they only collect their money and run away. A micro-finance group ran a 'Live Above Poverty Organization'. They collected money and lent money at an exorbitant rate. If a trader borrows 50 000 naira ($142.86) he/she must payback the principal money and the interest within 23 weeks at the rate of 4000 naira ($ 11.43) per week. This is very stressful for petty traders to be paying 4,000 naira every week. No major organisation is assisting households to live above the poverty line" [FGD_NN].

Why households are vulnerable to food insecurity

In this section, additional factors that cause households to be vulnerable to food insecurity are discussed, however, it is important to note that the VFII is not designed to explain why households are vulnerable to food insecurity. Table 9 presents a summary of the most

common reasons that were reported during the ground-truth exercise to explain why households in the community are vulnerable to food insecurity. These six reasons are: (1) hardship (house- holds could not afford to buy or produce quality food because of hyperinflation or high food price); (2) infertile soils; (3) loss of income (caused by joblessness and depreciation in value of the Naira); (4) severe hunger (resulting from a high crime rate, theft, and malnutrition); (5) economic challenges; and (6) corruption.
These reasons affected all households across the three food vulnerability groups. However, the impact was felt most by households who were highly and mildly vulnerable to food insecurity. The ground-truth exercise provides current reasons why households remain vulnerable to food insecurity and this supplementary information helps to contextualize the index approach.

Discussion

The VFII was internally validated by performing an uncertainty and sensitivity analysis (Ibok et al., 2019) and the results showed that the index is robust and highly sensitive in capturing the vulnerability component of food security. Therefore, the index it is deemed to be fit for purpose (Ibok et al., 2019). However, good practice in vulnerability analysis is to carry out an external verification of the VFII to identify the credibility of the index (Eriksen & Kelly, 2007) and, in this study, data from the South-South region of Nigeria was used to test the development of categories. This paper further validates the useful- ness of the VFII through a ground-truth exercise by verify the selection of indicators and compared local perception of households in Akwa Ibom State with the result of the VFII. Although the ground-truth exercise made use of a limited sample, it provided useful information that was used to make an inference to the study location only rather than the entire South-South region of Nigeria. Moreover, we think a more significant sample including more states and households would have been preferred. However, this was not achievable because of time constraint and the high cost of conducting this research, thus our sample size was restricted to one state.
The findings in section 4 show similarities between results of the exposure component of the index and the ground-truth data. Irrespective of the food vulnerability group, the findings show that the shock indicators used in designing the VFII were the same shocks that households were experiencing on the ground.

However, there were differences between the most prevalent shock in the urban and rural communities when the fieldwork results were compared with the VFII. The fieldwork shows that households in the urban community held the perception that “theft” was the shock with the highest prevalence, while the VFII showed that “high food price” was the shock with the highest prevalence at the state level. The same outcome also occurred when comparing the result of VFII with those from the field work for households in rural community. From the field work, the most prevalent shock for the rural household was “high food price”. However, at the state level, the result of VFII showed that “job loss” and “theft” were the shocks with the highest prevalence. The reason why the prevalence of shock did not match at the state and community level is because the data used in constructing the VFII was collected in 2011 while the verification exercise was done in 2018. Another reason could be as a result of the sampling size. Although the sampling size could not have captured the heterogeneity of all shocks in the community level, it is fairly representative for the purpose of validating the VFII. This is part of the challenges of validating a quantitative index on the ground.

In the rural context, a wide range of shocks were reported as most prevalent compared to the urban community, the VFII result at the state level was also sensitive to these differences.

The VFII was able to reflect much of the differential experience of vulnerability to food insecurity reported by households. This suggests that the index is sensitive to context-related factors, and therefore can be applied to a more heterogeneous context. The implication of this finding strengthens the credibility of the VFII because a vulnerability index that can be applied to an heterogenous context means that its indicators will be able to reflect real-life experiences on the ground.

Furthermore, the literature has focused on the problem of vulnerability indexes only providing a static measure of vulnerability (Campbell et al., 2016; Eriksen & Kelly, 2007; Himes-Cornell et al., 2016; Vincent & Cull, 2014). This study's findings emphasize the value of integrating an element of ground-truth data when designing vulnerability to food insecurity indexes because it allows for reflection and additions to be made to static indicators that most appropriately capture factors that affect households. The analysis showed that the indicators used in the index were highly relevant to operationalizing vulnerability to food insecurity. None of the indicators was excluded as a result of the ground-truth exercise as none were identified as irrelevant when explaining vulnerability to food insecurity. Rather, the ground-truth exercise suggested that more indicators might be included in the index. In the urban community, "erosion" and "waste disposal" were suggested while the rural community suggested "population" and "culture". This implies that there may be some very localized issues that the index does not capture, but necessary trade-offs must be made and, in this case, the number of indicators included reflects a lack of data and allows international comparison (Neset et al., 2018; OECD, 2008).

The ranking of indicators during the ground-truth exercise identified the relative importance of these indicators to the community. In the rural community, good roads, water sources, housing structure, income from jobs and harvested crops were considered the most important adaptive capacity indicators. Meanwhile, the most important adaptive capacity indicators in the urban community were considered to be education, income from non-farm enterprises, water sources and good roads. This implies that, for adaptive capacity indicators, rural households focused on the provision of basic infra- structure and livelihood resources to reduce vulnerability to food insecurity, while the urban community attached more importance to education, business, and provision of basic infrastructure. Therefore, while in the VFII all indicators are equally important when using state-level data, this is not the case at the community level where differential weights will be required.

At household level, the factors identified as shaping vulnerability to food insecurity were severe hunger, unemployment, economic challenges, infertile soil, corruption, and hardship. Economic challenges, infertile soils, corruption were not included in the VFII. By integrating these insights with the VFII design, the range of factors that cause households to be vulnerable to food insecurity are identified and shown in Figure 3. These factors are multidimensional, interrelated and often operate across different scales. For example, households cannot control inflation and the federal government's macroeconomic policies regulate inflation, but it is one of the factors that lead to severe hunger. This was reported because it causes an increase in the price of goods and services when real household income does not increase, which triggers the most vulnerable households into severe coping strategies.

Thus, factors that lead to food insecurity interact but the VFII could not show this interaction despite its multi-dimensional design. While the VFII identifies the relevant target populations as the starting point of the vulner- ability analysis, the ground-truth exercise ensured the

design is relevant and generated a more detailed understanding of context (Eriksen & Kelly, 2007; Himes-Cornell et al., 2016; Ribot, 2017; Vincent & Cull, 2014). While VFII modelling produces a generalized result, ground-truth data provide more specific insight and may be used as guidance to policymakers and practitioners on how to interpret the results of the index (Ribot, 2017). For example, insight on how households resist or recover from food-related shocks can be linked to household adaptive capacity.

The findings illustrate the seasonality is associated with vulnerability to food insecurity, with the peak of the hunger season being from January to March. Highly vulnerable households were most affected and often enacted severe coping strategies that led to the depletion of productive assets. Households that are facing chronic food insecurity stand a low chance of recovery according to Woller et al. (2013). Mildly vulnerable households enacted less severe coping strategies, but these too could become difficult to reverse in the future. The adaptive capacity component of the VFII uses indicators that identify long-term measures to reduce vulnerability to food insecurity while ground-truth coping strategies reflect short-term measures employed by households to recover from shocks that led to food insecurity. This implies that the VFII is useful for informing long-term food vulnerability reduction policies, but where short-term policies are needed, a ground-truth verification exercise should be used.

Highly vulnerable households were vulnerable to food insecurity because of long-term erosion of livelihood activities. This implies that households' assets, entitlement, and livelihoods had failed to buffer these households against food shortage, or they were not adequate and sustainable (Ribot, 2017; Woller et al., 2013). The lack of formal social protection mechanisms in Nigeria limits recovery for the most vulnerable. According to Merttens et al. (2013) and Hidrobo et al. (2018), social protection programs boost household food security by improving the quantity and quality of food consumed. This increases asset holdings and may increase the savings rate by up to 13%. Based on the indicators identified locally, several factors are needed to improve household adaptive capacity. These are: a reduction in the rate of unemployment; the development of an environment that encourages and sustains entrepreneurs; the provision of land for agriculture; the provision of free education by government; the improvement of general infrastructure, namely housing, roads, and electricity; the regulation of inflation and high food prices; and an increase in the minimum wage for civil servants.

Conclusion

The objectives of this study were to verify the results of a quantitative index (VFII) with real-life experiences on the ground and to qualitatively understand why households are vulnerable to food insecurity. The ground-truth exercise presented in this paper used a qualitative assessment method, which was compared with the results of the VFII, to validate the indicators.

The research found out that the ground-truth exercise identified the same factors as the VFII to explain household vulnerability to food insecurity. The same set of shocks was identified at the community level as were used to design the VFII from state-level data. The research also found all indicators included in the VFII to be relevant in explaining vulnerability to food insecurity at community and state level, and it was not necessary to exclude any indicators from the VFII as a result of the ground-truth exercise. However, at the community level and household level, supplementary indicators were identified that could be relevant to the local-level analysis. Households were also vulnerable to food insecurity because of

livelihood exposure to macro-level socio-economic factors but were unable to manage food shocks without any social protection mechanisms to buffer household adaptive capacity.

However, the prevalence of shocks at the state level did not match what was reported in the community. For example, at the state level, high food price was the shock with the highest prevalence while theft was the shock with the highest prevalence for urban households. Also, moving from one context to another (i.e. urban to rural community) the level of prevalence did not match. The rural community experienced a more differential vulnerability compared with the urban community. The shocks with the highest prevalence for households in the rural community were high food price, theft, job loss, illness, and poor rainfall. While, for urban households, shocks with the highest prevalence were theft, job loss, and high food price. This implies that the VFII may be applied to heterogeneous contexts because the index can identify some context-related factors. Nevertheless, for a VFII developed at the state level to be useful at the community level, the issue of scale should be reflected upon at the point of interpretation before use for targeting of any interventions.

This paper also reinforces that use of equal weights for indicators at the community level is not appropriate. The VFII was designed with equal weights based on the justification from the sensitivity and uncertainty analysis which mentioned that applying equal weight to the index provided a more robust and stable output compared to using different weights. However, the relative importance of VFII indicators varies from one community to another. For example, hunger was the sensitivity indicator with the highest importance for the rural community, while, for the urban community it was child mortality. Therefore, different weights should be applied at the community level, while equal weights can be retained at the state level. When moving from macro-level to micro-level, the application of different weights should stop at the community level because going further to apply household level would be expensive.

Combining the quantitative modelling of the VFII with ground-truth validation is important and complementary in the process of vulnerability analysis. An index is the starting point of vulnerability analysis because it identifies the location of the vulnerable population, which is important for targeting support. However, ground-truth validation ensures the analysis and recommendations from the index have local relevance at the point of interpretation. The VFII can, therefore, be useful in considering options for identifying long-term food vulnerability reduction policies and how these might impact different groups of people. However, where short-term policies are needed, ground-truth verification should be used.

Overall, the indicators used in the design of the VFII were the same as the indicators identified on the ground. However, application of the VFII below state level to identify food insecure households at the community level may require even greater consideration of the heterogeneous population and the relative importance of indicators. This means that, at the community level, the weight of indicators for the VFII should be adjusted to reflect the heterogeneous nature of the community. This involves deriving different weights for indicators using expert opinions. It is also recommended that a flexible weighting system should be applied when the index depends on local conditions.

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Table 1. Indicators and variables used for the vulnerability to food insecurity index

Index Dimension	Indicators	Description of variables
Exposure (Probability of covariate shocks occurring)	Health shock Unemployment shock Civil conflict shock Agro-climatic shock	Illness of income earning member Job loss Theft of crops, cash, livestock or other, kidnapping/hijacking/robbery/assault Poor rain that caused harvest failure Flooding that caused harvest failure
Sensitivity (Previous/accumulative experience of food insecurity)	Food price shock Malnutrition Child mortality Hunger	Increase in price of major food items consumed Length/height-for-age (stunting) Total number of children dead in each household Total number of days households went without eating any food
Adaptive Capacity (how household responds, exploits opportunities, resists or recovers from food insecurity shocks)	Wealth Index Access to infrastructure Livelihood activities Household literacy	Household assets used to assess information Mobility assets used in households Livelihood assets owned by households Housing structure characteristics Household distance to nearest major road (km) Time taken to walk one way to the water source from household dwelling (minutes) Household distance to nearest market (km) Total income from savings, rental of properties and other types of income Estimated revenue from non-farm enterprises Total yield of crops harvested (kg) Cumulative years of schooling for household heads or closest individual[a] in the household

[a]*This is the next individual in the household if education is missing for the household head, who has the highest level of education, and at least five years of schooling. If educational qualifications are the same for more than one individual, the most senior individual in age is used*.

Table 2. Local perceptions that characterize households into three food vulnerability groups

Not vulnerable	Mildly Vulnerable	Highly vulnerable
All children have completed university	Children completed primary or secondary school	Children attend public primary schools and secondary schools
Enjoys balanced diet	Out of 4 children, only one child may complete university	Children drop out of school often because the death of the main breadwinner
Eats broilers chicken	Struggles to afford two square meals per day	Can afford only one square meal per day
Can afford three square meals a day	Meals do not contain much carbohydrate	Consumes high carbohydrate meals
Has a private business of over one million naira ($2,857.14)	Business net worth between one hundred and two hundred thousand naira ($285.71 to $571.42)	Eats only local chicken
Can make up to a 100-million-naira ($285,714.28) investment outside the community	Uses water system toilet	Begs for food
Uses water system toilet	Job like a junior civil servant	Pit toilet or no toilet
Job like senior civil servant	Motorbike, tricycle	Jobs like farming, fishing, labouring, building
more than one car		Bicycle
Water system toilet		

Table 1: Sample size for focus group discussion and household interview

Ground-truth activities	**Urban community**	**Rural community**	**Total**
Focus group discussion	1	1	2
Households interview	5 non-vulnerable households	5 non-vulnerable households	30
	5 mildly vulnerable households	5 mildly vulnerable households	
	5 highly vulnerable households	5 highly vulnerable households	
Sub-total	15 households	15 households	

Table 4. Prevalence of food-related shocks by context and food vulnerability categories of sample households in South-South Nigeria.

	Shocks	**Highly vulnerable (%)**	**Mildly vulnerable (%)**	**Not vulnerable (%)**
Urban	Job loss	30.08	--	--
	None	--	4.35	52.7
	Poor rain	0.75	--	12.16
	Theft	23.31	17.39	6.76
	Food Price	39.1	73.91	28.38
	Kidnapping	6.77	4.35	--
Rural	Flooding	14.29	5.71	--
	Illness	23.6	21.43	6.52
	Job loss	9.01	7.14	4.35
	None	0.62	7.14	45.65
	Poor rain	6.52	12.86	14.49
	Theft	28.26	27.14	14.49
	Food Price	17.7	18.57	14.49

Table 2: Relative importance of VFII indicators at the community level

Shock	**Urban Community (Ibesikpo)**	**Rural Community (Ikono)**
Illness of breadwinner	5	4
Theft/Robbery	4	3
Poor rain that caused harvest failure	2	6
Flooding that caused harvest failure	7	5
Increase of price of major food item	6	7
Kidnapping	1	2
Unemployment/Job loss	7	6
Adaptive capacity		
Household asset	3	5
Mobility asset	1	6
Livelihood asset	9	3
Housing structure	2	9
Good roads	7	11
Nearest market	6	1
Water source	8	10
Income from jobs	4	8
Income from non-farm enterprise	10	2
Harvest crops	5	7
Education	11	4
Sensitivity		
Stunting	1	2
Child mortality	3	1
Starvation (Hunger)	2	3
Additional indicators proposed by participants	• Erosion • Waste disposal	• Population • Culture

Table 6. Perceptions of the prevalence of shocks experienced in urban communities (illustrative comments from fieldwork data).

Exposure Component		
Highly Vulnerable	**Mildly Vulnerable**	**Not Vulnerable**
"I was a petty trader selling *Afang* in the market. As things became expensive, I started using my business capital to feed my children. In the long run, the capital got finish, and my business was closed down" [HH004NN]. "The shock that is affecting my household is high food price. My mother's generation, they used small money like N1,000 to buy much food. Now, with the same amount, I cannot even cook a good pot of soup not to talk about buying garri. This is why we are facing hardship. We cannot feed our children now and cannot send them to good school" [HH002NN].	"For my households, the real problem we have is that for two years now we do not have electricity in this community. Because many houses have been built over time and the electricity load has increased making the transformer to overwork itself. This makes all transformers in the community to become damage. Hence no electricity. This cause hoodlums and thieves to enter the community and when they do not see money to steal in your house, they kill you. Just yesterday, thieves entered a nearby neighbours' house [an elderly women], she did not have money, so instead they ate her soup and used the pot to cover her head. This shows that there is hunger in the community" [HH007NN]	"My tenant grows pears, mangoes, cassava, plantain, and fish farm. However, thieves jump the fence to steal everything in his farm. For two years now, he cannot pay house rent. When he wakes up thieves have harvested all his crops" [HH012NN]. "There are no jobs now. So many people that are begging for money now. Some will ask that you should not send them the money rather use the money to buy food and send it to them. Things are very hard. Many people have withdrawn children from school. The parent cannot pay private school fees" [HH012NN]. "This group of people do not have a job. Some people will have job. If you do not have money, you cannot buy food. I have a group of friends who were former Directors in a Government organisation but are now pensioners. They cannot pay house rent. One among them relocated to live in his village. He cannot pay the fees of his children. Now if you see him, you cannot recognise him. Things are so hard that I can compare it to the period when Nigeria was in civil war. We used to see how people will die of starvation; many children had kwashiorkor and big head. When you lose your job, your financial obligations keep coming, like paying fees for children, feeding your family, transportation, accommodation, etc." [HH0015NN]

Source: Field work survey

Table 7. Comments from the ground-truth exercise about the prevalence of shocks experienced by rural households in Ikono community, Akwa Ibom State (illustrative quotes from field work data).

Exposure component		
Highly vulnerable	Mildly vulnerable	Not vulnerable
"Foodstuff are costly. No money to buy enough food. I have many children, so this food is not enough for my children. My children are going to school and am paying their fees" [HH001IK]. "For example, fish that we use to buy like N10,000 it is over N30,000 now. The cost has increased by three times. Garri use to be 4 cups for N200, but now I cannot afford to buy garri and not to talk about eating good food" [HH004IK].	"It causes the people around me to be thieves because they are jobless. They are forced to steal. I kept 12 brooms outside my house, just in front of my corridor. By the time I came to look for it the next day, nine brooms were stolen. The yam that I planted all were harvested by thieves" [HH008IK] "I experience Arthritis because of eating poor quality food that contains too much unhealthy ingredients like Maggi. I used this unhealthy ingredient to substitute for the healthy ingredient like crayfish. Because crayfish is too expensive. [HH006IK].	"Even in your farm, you can go and see a thieve harvesting your plant. When you ask him why you are doing this, the thief will say he does not want to die of starvation. On my farm, where I gave someone to plant for me, thieves came in and harvested the corn, plantain, cassava, and melon. This makes people abandon their farm. Neighbours all will release their goat into your farm, and this goat will eat everything in your farm. There are two categories of thieves: food/farm thieve and original thief" [HH0014IK]. "Because of poor rainfall my shrub called "hospital is too far" is dying. There is no sickness that this shrub cannot cue. However, because of poor rainfall, this plant is dying and has become stunted" [HH0015IK].

Source: Field work survey

Table 3: Coping strategies used by urban and rural households in Akwa Ibom State when food is lacking

Coping strategy	Highly vulnerable	Mildly vulnerable	Not vulnerable
Urban Households	"We borrow money to feed ourselves and pay house rent". "I had no alternative than to withdraw my	"I go and borrow money to feed my family". "We skip meals. If you eat in the morning, you skip	"We look for where to buy food at a cheap rate". "Buy food in bulk".

	children from school". "We stay hungry or reduce the quality and quantity of our food".	afternoon and eat dinner. Sometimes we go for obligatory fasting. Because we do not eat fine, there is malnutrition. We are not healthy because we are not well nourished."	"Having additional business like tailoring".
Rural Households	"We stay hungry and endure until we see food to eat". "We eat palm kernel, boiled cassava, and boiled cocoyam". "We plant cassava so that we will at least have food to eat. However, cows destroy it".	"When food is expensive we reduce the quality of our meal or skips some meal". "Whatever food I can find in my farm that is what we will eat. For example, cocoyam".	"Reduce the quality and quantity of the food". "Hawking of food in the street to augment household income".

Table 9. Reasons that were reported for why households were vulnerable to food insecurity.

S/N	Food vulnerability reason	Comments from households
1	Hardship	"I reduce the quality of our meal because of hardship. I am a civil servant; the same money I used to collect in President Goodluck regime (when things were cheaper than now) is the same money I am collecting now. This salary cannot cope with the present high cost of food that we are experiencing. We have to manage; this means reducing the quality of the meals we eat" [IK]. "If there are jobs, young people will not be engaging in this activity. They are very hungry in addition to hyperinflation of goods and services; this makes our youth to become armed robbers" [NN].
2.	Infertile soil	"Now we make use of fertilizer to plant. So, this makes our soil to be fertile. We use too much chemical like herbicide that is dangerous to our soil. When we use fertilizer during the planting of yam, it makes this yam to wilt and become watery during storage. The solution is for us to stop using fertilizer always and apply farm yard manure. But there is no sufficient quantity of farmyard manure, and if everybody wants to patronize this, it will not be affordable because of the high price" [IK].
3.	Loss of income	"There are no jobs now. So many people are begging for money now. Some will ask that you should not send them the money rather use the money to buy food. Things are very costly. Many people have withdrawn children from school. The parents cannot pay private school fees" [NN].
4.	Severe hunger	"Since President Buhari came to power people are dying like flies. Hunger has killed several people in this community. There is no money to buy food to eat. People are not feeding the way they are supposed to feed. There are people at their very best that can only feed once in a day. Some households have up to 5 or 6 children but it is very hard for them to feed three times in a day" [NN].
5.	Economic challenges	"In President Goodluck's regime things were still difficult, but food was available in abundance. During his tenure, food items worth of N100, 000 ($278)4 was more than a food item of President Buhari regime. This is because of high food price and inflation in Buhari regime compared Goodluck regime. In Goodluck's regime, food was not as expensive as it is now. In Goodluck's regime, I used N150 ($0.42)stockfish head for cooking, but now am using N500 ($1.4) no matter if the soup is small. Eight cups of garri cost N200 ($0.56) then, now it is 3 cups for N200 for us, but in uyo, it is six small cups of garri at N200.

		One bag of rice was N11,000 ($30.6) but now one bag of rice costs N21,500 ($57.2)" [NN]. "Ten years ago, I used to use N250 ($0.94)and buy foodstuff. This foodstuff will fill my shopping bag. The cost of a bottle of oil was N50. My husband was a palm oil farmer. He would produce the palm oil, and I went to sell it and get N700 ($1.94) as profit. He would then remove N250 and give it to me to buy food for the house. I used to buy things from the market, and it would fill my shopping bag. Now if you are given N100,000 ($278) for household food shopping, you will go to the market and come back with a little small bag. The food items will not satisfy the household for up to three days. Things are so expensive now. Goodluck's regime was better than Buhari regime. It is not easy for households with three to four children to feed three square meal per day" [NN].
6.	Corruption	"I discovered that government would release money for a project, but the people handling this project steal the money or used the money for another thing. Do you have any idea or solution for this problem? I do not think in Nigeria there will be the solution to this problem because corruption starts from the top. The people at the top are very corrupt. A way out is to start fighting corruption from the top. So that money meant for a specific project will be well utilized. There should be a monitoring team to monitor and supervise any money released by the government" [IK].

Figure 1. Food vulnerability map of states in South-South Region of Nigeria.
Source: Author developed from the VFII results using Tableau

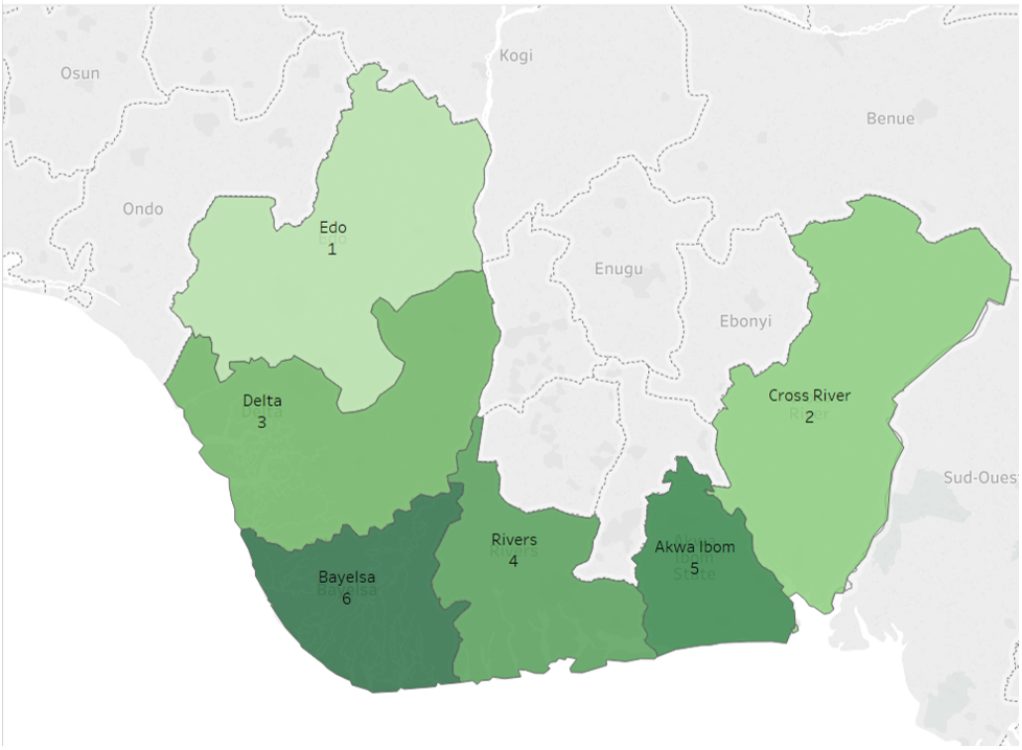

Figure 1: Prevalence of shocks by sector for households in Akwa Ibom State

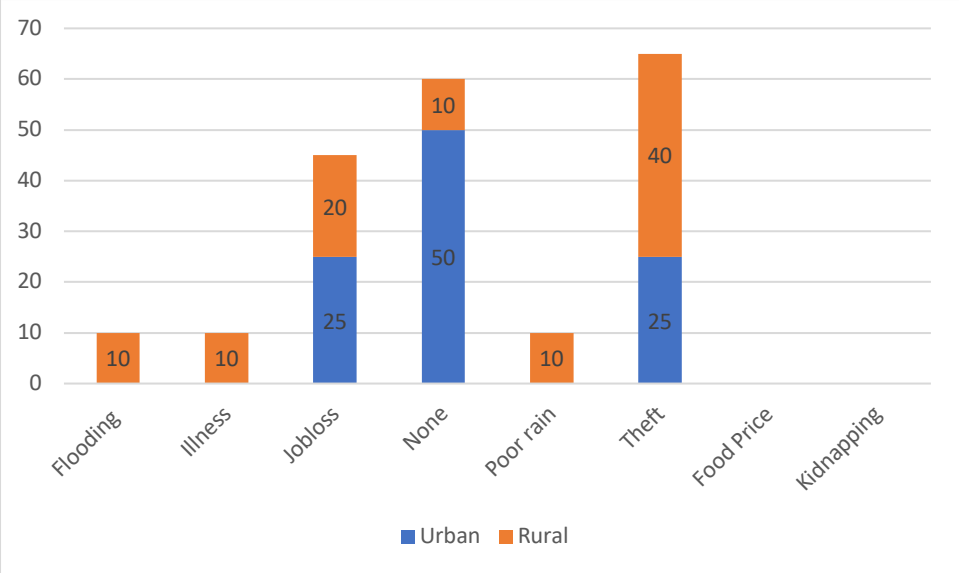
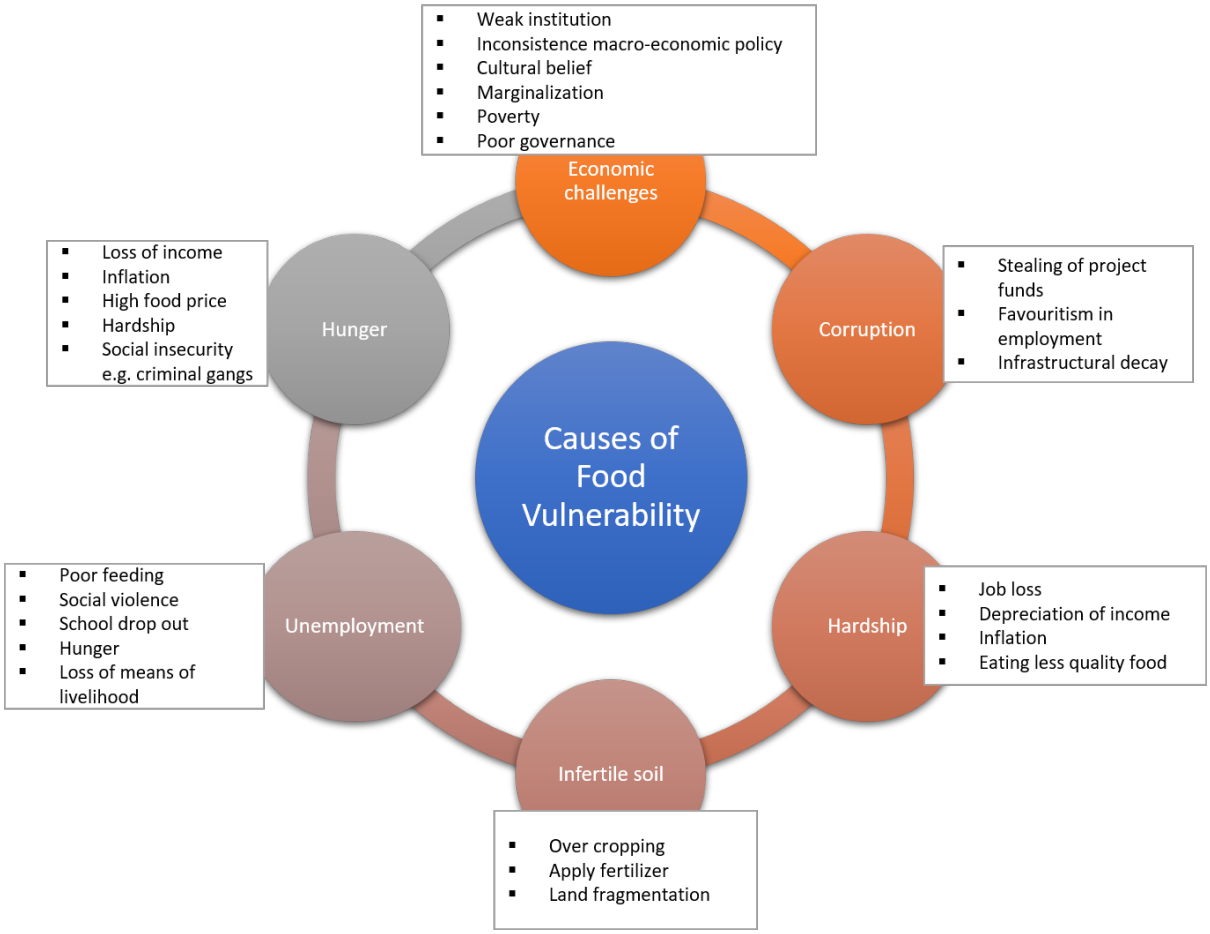
Figure 3. Causes of food vulnerability at the household level. Source: Developed by the author from the ground-truth exercise in *Ikono* and *Ibesikpo* community