MEDWIN PUBLISHERS
Committed to create value for Researchers

Food Science and Nutrition Technology
ISSN: 2574-2701

Beyond Availability and Access: The Importance of Monitoring Resilience and Risk of Food Insecurity

Laila B Lokosang[1]* and Temesgen Zewotir[2]

[1]Food and Nutrition Security Advisor, Department of Rural Economy and Agriculture, African Union Commission, Addis Ababa, Ethiopia

[2]Professor of Statistics, School of Mathematics, Statistics and Computer Science, University of Kwazulu-Natal, Durban, South Africa

Policy Article

Volume 4 Issue 5

Received Date: September 24, 2019

Published Date: October 23, 2019

DOI: 10.23880/fsnt-16000195

***Corresponding author:** Laila B Lokosang, Food and Nutrition Security Advisor, Department of Rural Economy and Agriculture, African Union Commission, Addis Ababa, Ethiopia, Email: lblokosang@gmail.com

Abstract

Food insecurity has gained considerable global attention in the past two decades, ranking top of the Millennium and Sustainable Development Goals. Although the subject has received considerable research, it was largely centred on describing the incidence of food insecurity and vulnerability; with food availability and access often the domains of focus. Limited research was done to strengthen the importance of food insecurity risk in order to inform programming and decision making for reducing future vulnerability, strengthening population resilience and early warning measures. Meanwhile, statistically robust analytical approaches are now available for determining potential food insecurity risk, especially in protracted crisis.

Keywords: Structural Food Insecurity; Protracted Crisis; Livelihood Capitals; Vulnerability; Household Resilience

Introduction

Africa is overwhelmed by protracted crisis that often include acute or chronic food shortage and hunger. Of recent, famines have ravaged parts of the continent, such as the Horn of Africa, the Sahel Region, northern Kenya, South Sudan and north-eastern Nigeria. Conflict, lack of or inadequate distribution of food reserves, flash flood and drought are mainly responsible for causing hunger and chronic food emergencies. Russo, et al. Citing Flores, et al. [1,2] define protracted crises to be situations where large sections of populations are faced with acute threat to life and livelihoods over extended periods, especially when state and governance institutions fail to provide adequate levels of protections. Protracted food emergencies can by themselves inadvertently become a cause for conflict and the vicious cycle continues. When a situation of structured food insecurity and malnutrition emergency is not addressed, it can by itself inadvertently cause or exacerbate tensions or conflict Committee on World Food Security [3]. Severe food insecurity causes anxiety, which in turn causes desperation, which in turn causes households to resort to extreme or even unthinkable forms of survival or coping strategies. In situations where firearms are rampant, extreme coping strategies might be in the form of banditry, armed robbery and rustling of cattle - a practice existing amongst pastoralist communities of South Sudan.

Protracted or chronic food insecurity disables development and tear apart social fabrics of affected communities. Russo, et al. [1] argue that achieving food security in crises of a complex and protracted nature can be a daunting task, as states become fragile. Schafer [4] includes high vulnerability of livelihoods to external shocks and existence of serious poverty among several elements characterising protracted crises. This implies that vulnerability is most serious in protracted crisis and thus exacerbates poverty. It is on these grounds that development and relief need to go side-by-side such as in the case of the UN 'twin track' approach for intervening in crises in Sudan, Somalia and the Democratic Republic of Congo. The range of developmental interventions included livestock development, trade and veterinary services Bishop, et al. [5] and developmental programmes aimed at sustaining local solutions with local community participation [6].

The main sources of food insecurity risk or food emergencies can be categorised into four major domains: natural (floods, typhoons, cyclones, drought and crop failure), economic (sharp strategic consumer commodity price hikes, rising farming input costs, inflation and trade sanctions), man-made disasters (mainly conflict, hoarding and strikes) and social (outbreak of diseases). Each of these sources of food insecurity can hit populations hard, especially where resilience is weakened. Famine is often an epitome of food insecurity risk in settings where resilience is very weak [7].

Technically, resilience is defined as the ability of a household to resist, absorb, cope with and recover from the effects of shocks and to adapt to longer time changes in a timely and efficient manner. Pasteur [8] sums up the definition of resilience to food insecurity risk as the capacity to endure food insecurity shocks and stressors and bounce back. The concept of resilience, therefore, derives from the need to prevent adverse and serious effects that associated crisis come with. Emergencies of all sorts are bound to occur anyway. Shocks should not be hitting the same populations over and over again.

It is, therefore, of relevance creating and supporting interventions for building population resilience, especially those with vulnerabilities related to income poverty, resource depravation and lack of certain geographical endowments and limited social and economic capital. Equally of relevance is aiming to assess the amount of and factors for improving resilience in population groups that are vulnerable to food insecurity risk. It is by so doing that risks can be averted through early warning and preparedness. The International Food Policy Research Institute [9] reinforces this point in that building resilience enables prevention against adverse livelihood and food insecurity shocks so as not to bearing negatively on resource poor communities.

Another rationale that lends credence to the importance of food insecurity risk is derived from one of the African Union's flagship programmes for stimulating development in Africa. This is the Comprehensive Africa Agriculture Development Programme (CAADP) and particularly Framework for African Food Security (FAFS), which, among others, aims "to improve risk management at the household, community, national and regional levels" New Partnership for Africa's Development [10].

Poverty, which is rampant in Africa, causes populations to lack steady income and assets, thus resulting in high vulnerability and inability to cope with uncertainties, depleted productive assets and unsustainable livelihoods. Poor households often spend significant proportion of their income on food, and when they are able to produce food, they encounter other constraints that limit them to access inputs and markets.

Considering this characteristic weakness causing poor access to food and uncertainty in food availability, it is rational to step beyond interventions for improving food availability and access by taking it to how to improve the very factors that make the vulnerable to withstand risk, such as providing them with means to access income, accumulate and sustain assets, sustain their livelihoods and access infrastructure.

It is to be noted that experts in social development, poverty eradication and livelihoods improvement, have asserted that social protection is of high relevance in an agricultural development and food security agenda. Of late a number of recommendations and conceptual frameworks have come out that propose mainstreaming social protection into agriculture and food security and nutrition frameworks. The Malabo Declaration on Agriculture Africa Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods African Union Commission [11] called for African countries "to integrate measures for increased agricultural productivity with social protection initiatives focusing on vulnerable social groups". Indeed, with poverty and hunger persisting despite reported overall growth in the agriculture sector, and a large proportion of population depending on agriculture, rural development interventions should necessarily integrate agriculture and

social protection outputs. Some strong argument along this line is that presented by Slater, et al. [12], Tirivayi, et al. [13] who propose that governments and development partners should consider supporting programmes which combine promoting rural and agriculture sector growth as a measure to protect those who do not have the capability to produce food by themselves.

Methods

Emergence of Measures Based on Household Resilience to Food Insecurity Risk

Lokosang, et al. [7] employ statistically rigorous tools for measuring the likelihood of food insecurity risk. Their approach builds on works by Food and Agricultural Organisation [14] & Alinovi, et al. (2010) [15] who estimate household resilience to food insecurity shocks as a function of seven livelihood constructs, namely; Income and food access; access to basic services; agricultural assets/non-agricultural assets; enabling institutional environment; climate change; agricultural practice and technology; and social safety nets. This is aimed to take monitoring of food in/security status to beyond examining availability and access.

The thrust of this new approach rests in that as the field of food security is expanding rapidly due to the outlined challenges, the need for more convincing and statistically established evidence is equally growing. Therefore, employing statistically robust methods, we hope to strengthen food security monitoring, evaluation and reporting systems to provide valid evidence for timely decision making and intervention.

Based on datasets from national surveys conducted in South Sudan, the cited work has led to constructing asset-based indices for determining the likelihood of food insecurity risk. The following sections, therefore, present two distinct approaches for determining food insecurity risk, profiling inequalities with regard to levels of resilience to food insecurity shocks. This is thought to establish relevance of the approach to early warning and decision making, especially in protracted crisis settings.

Conceptually, if the strength of people's resilience could be classified and predicted, it could be possible to influence decisions, leading to preventive or early preparedness actions. Therefore, it is deemed relevant attempting to offer a viable tool for humanitarian and development programmes to intervene timely, and from an informed view point, by targeting populations most at risk of food insecurity. Analysts and programme designers may also use the evidence for intensifying preventive action measures. Presented in this chapter are two approaches for predicting or classifying the likelihood of risk and profiling populations. These are factor analysis based approach and modelling; both based on assets and livelihood amenities.

Rationale of the Study

Our motivation is to stimulate a new thinking and shift away from focusing attention only on food availability and access, especially when it comes to using evidence for identifying the possible triggers of vulnerability and planning food insecurity mitigation interventions. It presents two analytical approaches and their findings that have established that examining resilience and food insecurity risk, especially in settings characterised by protracted food crises and emergencies. Analysis based on household assets, sources of livelihood and attributes are found to be a good basis in determining the potential of food insecurity risk and the likelihood of a population experiencing vulnerability.

Another aim of this chapter is to unveil a new area of food security research which is based on statistically robust measurement methods. The approaches discussed below attempt to walk the reader through different steps in developing two tools that can be used for measuring the population resilience and generating profiles of food insecurity risk. It is worth noting that the approaches are based on two peer reviewed and published articles and thesis by Lokosang, et al. [16-18].

Data and Statistical Methods Used

We feature two different datasets and two statistical analytical methods. The first of the studies was based on a dataset from South Sudan - 2009 National Household Baseline Survey from a random sample of just under 5000 households. This dataset was chosen because it contains variables that suit the purpose of the study - measuring household asset-based population resilience to food insecurity. The statistical technique Principal Component Analysis was deployed because it is useful in deriving some latent variables (or principal components) based on the weight of assets owned or household attributes. We employed the statistical package IBM SPSS [19] Factor Analysis technique to compute Z-scores to generate a single summative indicator. We named this indicator Household Resilience Index, which was then used to profile resilience according to geographical and demographic setting.

In the second study, we used a dataset from a survey from South Sudan - Food Security Monitoring Survey World Food Programme [20], which also included the required data on household assets, characteristics and endowments. The Survey Logistic Regression Model Roberts, et al. [21] was used considering that the data came from a complex design (stratified sampling). Based on the analysis a 'best-fit' model was selected that identified factors that associated significantly with the response variable; food consumption score being 'acceptable'.

Since the purpose of the study was to determine whether there was strong statistical evidence suggesting that some factors variables were possible predictors of household food consumption, it was necessary to identify the variables with significant estimates, that is, whose parameter values differed significantly differed from zero in terms of the relationship with food consumption score.

Using Asset-Based Index for Determining the Likelihood of Food Insecurity Risk

Food insecurity, malnutrition, health and livelihood surveillance data are available in most Sub-Saharan Africa countries. The sources for these data are Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), National Baseline Household Surveys (NBHS)), Annual Needs and Livelihoods Assessments (ANLA) and others, which are conducted in periods ranging from three to five years. These surveys readily collect data on a number of household characteristics, livelihood capitals and endowments, and sources of livelihood (farming, livestock, fishing, business enterprise and others). Following in a study by Lokosang, et al. [16], Filmer & Pritchett [22] a household food security resilience index can be generated based on a set of these variables applying the computational procedure Principal Component Analysis (PCA).

It is perhaps important to generate an understanding of why an index based on household assets is instrumental in food insecurity risk analysis. To begin with, let us appreciate that household resilience helps lower risk or the undesired effects of emergencies. Intuitively, resilience is a direct function of availability of household assets and livelihood capitals. According to the Department for International Development [23], these are human, natural, financial, physical and social assets which a household owns. These livelihood capitals can influence certain wellbeing outcomes such as socioeconomic and food security status, which in turn can influence the ability to own household assets and wellbeing resources. Putting it in another way, in the eventuality of food insecurity uncertainties, affording certain assets, the value of certain livelihood capitals, and having certain household endowments, strengthen the resilience of the household. Therefore, there is strong reason to appreciate that inequalities in levels of livelihood capitals can be a proxy to the likelihood of food insecurity risk.

To construct the Household Resilience Index (HRI), a number of selected variables (household characteristics, durable and semi-durable assets owned and sources of livelihood) are analysed using SPSS Factor Analysis procedure to obtain z-scores by standardizing the indicator variables and their corresponding factor loadings and virtually the household index values. The HRI is the first component that reasonably explains adequate amount of variance.

The final step is to obtain the profiles of the HRIs in the specific area or country. This is done by grouping the HRI into quintiles (i.e., any of five equal groups into which a population can be divided according to the distribution of values of a particular variable) to form five resilience categories, namely: "very weak" (the household scores from 0 to the 20th percentile); "weak" (the household scores from the 21st to the 40th percentile), 'moderate' (the household scores above 40th to the 60th percentile); "high" (the household scores above 60th to the 80th percentile; and "strong" (household scores from the 80th percentile and above). In order to determine the resilience profiles for a specific country, the resilience levels are cross-matched against each region, district or state in that country, in order to make comparisons and note down any disparities in terms of resilience levels and by proxy food insecurity risk profiles. In the case of South Sudan, Lokosang, et al. [16] obtained resilience profiles for each of the tens states as shown in Table 1 below.

State	Household Resilience Index				
	Very Weak	Weak	Moderate	High	Strong
Upper Nile	16.5	19.2	23.5	19.9	20.9
Jonglei	22.6	37.7	20.0	14.5	5.2
Unity	23.3	23.1	22.5	18.3	12.8

Warrap	32.6	23.9	21.3	14.4	7.8
Northern Bahr el Ghazal	25.8	22.9	24.2	16.9	10.3
Western Bahr-el- Ghazal	16.9	7.0	25.3	18.3	32.5
Lakes	27.0	12.4	26.4	20.9	13.2
Western Equatoria	6.3	2.9	8.4	43.4	39.0
Central Equatoria	10.2	10.0	14.2	23.2	42.5
Eastern Equatoria	39.5	25.9	12.1	9.8	12.7

Table 1: South Sudan State Resilience Profiles in terms of Household Resilience Index**.**

From this profiling, the states with 'strong' resilience to potential food insecurity shocks, thus characterised as 'low risk', with score of above 30 percent, can easily identified. These are Central Equatoria, Eastern Equatoria and Western Bahr-el-Ghazal. A straight forward interpretation of this result is that these states are located in the Greenbelt agro-ecological zone, and inhabited by populations that largely depend on agriculture as their main source of livelihood. Conditions in this agro-ecological zone favour farming with rich iron soil and average annual rainfall of 1800 millimetres. As for the states characterised with 'generally weak' resilience (Eastern Equatoria, Warrap, Lakes and Northern Bahr-el-Ghazal), are largely occupied by pastoralist population and characterised with high displacement prior to the period of data collection.

The measure of household resilience to risk of food insecurity is merited in six different areas Lokosang, et al. [16]. First, as a single summative (composite) indicator, which is constructed based on weights of several variables, it serves as a universal measure of resilience to livelihood and food insecurity risk. It ascertains how households or population groups can cope in the eventuality of food insecurity risk. Second, the index has been established as a good alternative of money metrics which are based on income or consumption expenditure data, such as the wealth index. According to Gwatkin, et al. [24] income measures are prone to practical difficulties such as recall bias, reluctance to disclose amount of income earnings, and lack of record keeping of money spent. Moreover, consumption data may be affected by endogenous factors such as seasonality and weather conditions.

Thirdly, the HRI has been established to be capable of predicting the probability of socioeconomic conditions, including wealth, food consumption levels, etc. It can also inform food insecurity vulnerability analysts to plan long-term interventions to limit adverse effects due to conditions threatening the livelihood of populations. The index is further merited in that it can explain the disparities in socioeconomic status among population groups. This finding crossmatches that by Sahn & Stifel [25] who observe that the index based computed based on household assets and livelihood endowments is a valid predictor of manifestations of poverty, such as health and chronic malnutrition. Moreover Filmer & Pritchett [26] find the index based on household consumption data to be a reliable predictor of school enrolment.

Fourth, the index provides basis for profiling resilience according to geographic setting (e.g. region, state or county/district) or population groups. In so doing the metric can be used as a tool for early warning, for instance, in showing which region/county/district low or weak resilience and thus high risk of becoming vulnerable in the eventuality of calamities. Fifth, the index is established to be simple to derive and interpret as it is computed based on nationwide data which are readily available Filmer & Scott [27]. Moser & Felton [2] and Morris, et al. [28], [29,30] share the same observation.

Finally, the index is established to exert durability in that is based on durable and semi-durable assets owned by households, economic property, such as farming land, cattle wealth, and household attributes (e.g, type of house, sources of lighting and energy). It, therefore, qualifies to be a measure of medium- to long-term resilience of the household to food insecurity risk.

In conclusion, it has been established that the Household Resilience Index is a handy tool in determining inequalities in resilience of population groups to food insecurity risk. There are sufficient empirical grounds to assert that the index can be a reliable measure of food insecurity risk and identifying territories in a country which have weak resilience or stand being affected should food insecurity or other calamities hit. Therefore, the

measure seems to unveil sound evidence for using it in early warning and disaster preparedness.

Modelling the Relationship between Food Consumption Score and Household Characteristics and Means of Livelihood

In an effort to find a statistically robust and efficient measure for identifying a set of factors (household attributes and sources of livelihood) that determine or predict the food insecurity risk. Based on a dataset obtained from South Sudan World Food Programme [20], Lokosang, et al. [17] employed the statistical technique Survey Logistic Regression Model to model the relationship between a set of household demographics (age and gender of household head and household size) and sources of livelihoods (as explanatory variables or predictors) and food consumption score (as outcome variable). The main sources of livelihood include crop cultivation, fishing, and livestock ownership. The outcome variable Food Consumption Score (FCS) is in the form of three ordered categorical data and its frequency profiles are described in (Table 2) below.

Level	FCS Category	Frequency	%
3	Acceptable	2209	59.8
2	Borderline	1053	28.5
1	Poor	430	11.6

Table 2: South Sudan Profile of Food Consumption Scores.

Modelling the data generated the coefficients of each factor (or predictor) of food consumption score. Each factor coefficient reflects its influence on food consumption score (FCS). A factor level with a higher coefficient indicates a greater probability of being in one of the upper level categories of the cumulative FCS. A factor with a negative sign indicates that its level had a negative effect on the corresponding category of FCS. Conversely, a factor with a positive sign corresponding to a category (e.g. male for gender) indicates a positive association with the reference category of the response variable. The maximum likelihood estimates shown in (Table 3) indicate that households headed by males aged 60 years or less, had six members or less, cultivated crops, owned livestock, had a member who did fishing and earned incomes from sale of livestock or animal products, had better chance of associating with 'acceptable' food consumption score compared to those headed by females who were over 60 years, had seven or more members, did not cultivate crops, did not own livestock and lived mainly on agriculture and wages. In practice this implies that these factors were typical determinants of how a well or worse a household consumed food. Crop cultivation for food and income and ownership of livestock improved the consumption levels, vis-à-vis coping with or resilient to food insecurity strains.

Parameter*	FCS	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept=poor	Poor	-11.7454	1.0922	115.6382	<0.0001
Intercept=borderline	Borderline	-11.6719	1.0509	123.3672	<0.0001
Age of HH head ≤17 years	Poor	1.0855	0.5211	4.3393	0.0372
Age of HH head ≤17 years	Borderline	0.418	0.5167	0.6546	0.4185
Age of HH head=18-60 years	Poor	-0.4507	0.3054	2.1783	0.14
Age of HH head=18-60 years	Borderline	-0.1195	0.2448	0.2382	0.6255
Gender of HH head=male	Poor	-0.3877	0.1289	9.0396	0.0026
Gender of HH head=male	Borderline	-0.2378	0.1022	5.4093	0.02
Household Size ≤3	Poor	0.7661	0.2136	12.8659	0.0003
Household Size ≤3	Borderline	0.2937	0.1737	2.8609	0.0908
Household Size=4-6	Poor	0.5203	0.1392	13.9708	0.0002
Household Size=4-6	Borderline	0.0998	0.0942	1.1235	0.2892
Cultivated crops=yes	Poor	-0.4324	0.162	7.1286	0.0076
Cultivated crops=yes	Borderline	-0.3038	0.1151	6.9613	0.0083
Livestock=yes	Poor	11.3342	1.0215	123.1167	<0.0001
Livestock=yes	Borderline	11.4847	1.0082	129.7491	<0.0001

Fishing=yes	Poor	-0.0132	0.1863	0.005	0.9437
Fishing=yes	Borderline	-0.4197	0.1606	6.8269	0.009
Livelihood= agriculture	Poor	-0.5389	0.1568	11.8121	0.0006
Livelihood= agriculture	Borderline	0.1531	0.1144	1.79	0.1809
Livelihood=livestock	Poor	-0.8409	0.2072	16.4738	<0.0001
Livelihood=livestock	Borderline	-0.4421	0.1317	11.2769	0.0008
Livelihood= salaries	Poor	-0.1127	0.1651	0.4663	0.4947
Livelihood=salaries	Borderline	-0.1646	0.1303	1.597	0.2063

Table 3: Analysis of Maximum Likelihood Estimates**.**
*Last category level of each factor is the reference; HH=Household; Pr=Probability; ChiSq=Chi-square

In general, data analysis showed the model employed as robust and relatively efficient for predicting the likelihood of occurrence of food insecurity risk. All the seven selected variables fitted in the Survey Logistic model of the generalized logit type, were determined to be possible predictors of food consumption score. This implies that these variables improves the resilience to food insecurity and thus reduces risk of a population becoming variable in food insecurity crisis. Although not shown, an examination of the model fit showed reasonably satisfactory goodness-of-fit statistics. Both the Pearson's Chi-square and Deviance Chi-square values being non-significant, which indicated that the observed data and the model predictions were similar. This finding, therefore, gives reason to recommend the method as appropriate for analysing similar data. The method may also be explored to generate evidence in situations of responding to food insecurity crisis and disaster recovery. For more on this point, see Lokosang, et al. [7].

Conclusion

The need to cope with food insecurity risk, when it occurs, has motivated the shift away from earlier focus on measuring vulnerability based on determinants of food availability and access. Unlike vulnerability, resilience and risk determination measures are forward-looking or measuring an event before it occurs (*ante hoc*), as they aim to anticipate what might happen in the event of shock. Vulnerability to food insecurity is prevented or worsened by low or high level of resilience in a population. The fact that the measures discussed in this chapter make it possible to classify population groups or geographical settings according to their strength of resilience, lends credence to using them. That is, it makes them useful and versatile.

The Household Resilience Index a summative measure - is established to predict food in/security outcome variable based on food consumption data. It is shown to be a robust and efficient measure that provides the evidence for triggering alerts and action required for curbing food insecurity risk in the eventuality of food uncertainties.

The measure based on modelling household characteristics and livelihood endowments is also shown to exert reasonable statistical efficiency and provides sufficient evidence for food security analysis and food policy makers. The measure is handy for early warning and preparedness interventions, especially in settings characterised with protracted crises. The first principle of the Framework for Food Security in Protracted Crisis - a document of the Committee on World Food Security (CFS) - is on meeting humanitarian and development needs and build resilient livelihoods. It recommends, among others, that food interventions should "align humanitarian and development approached using the existing capacities and strategies of households and communities as entry points for policy and actions, particularly in situations of weak and governance and state fragility". This provides a solid ground to the case advanced in this chapter, that is, for measures that go beyond just availability of and accessibility and access to food. It also shows that measuring resilience to food insecurity is fast becoming relevant, convenient and urgent. The resilience measure exerts an intrinsic value of cushioning against future vulnerability.

It has to be borne in mind, however, that the analytical methods used in the study are not short of limitations. One of these limitations is owing to that both data used come from long questionnaires, which often tend to be poor and prone to respondent and interviewer fatigue. Another potential weakness is that the study datasets were from one-stop survey and from longitudinal and cohort studies. These imitations could be controlled by undertaking a more controlled study of cohort households and using simple questionnaire with specific research questions commensurate with the purpose of the study

and one that produces more accurate, complete and cleaner data.

In general, it has been shown that measures aimed at assessing levels of and profiling population resilience to food insecurity risk, are grounded on sound rationale and are worth exploring. Accordingly, we propose a new "food security informatics" field of study that incorporates statistically robust and sound methods for measuring vulnerability to and risk of food insecurity. Such domain of information and knowledge generation can enrich evidence generated for developing and informing interventions. It will combine the use of routine service statistics and cohort studies as sources of data to be used in determining and profiling vulnerability and risk, especially in settings with protracted crises, such as conflict affected areas, populations living in areas with adverse weather effects, etc.

References

1. Russo L, Alinovi L, Hemrich G (2008) Food security in protracted crisis situations: Issues and challenges. In Beyond Relief: Food Security in Protracted Crises. Rugby: Practical Action Publishing.

2. Moser C, Felton A (2007) The construction of an asset index measuring asset accumulation in Ecuador, Washington DC.

3. Committee on World Food Security (2015) Framework for Action for Food Security and Nutrition in Protracted Crises, Rome.

4. Chafer J (2002) Supporting livelihoods in situations of chronic conflict and political instability: Overview of conceptual issues, Brighton, UK.

5. Bishop S, Catley A, Hassan HS (2008) Livestock and livelihoods in protracted crisis: The case of southern Somalia. In: Alinovi L, Hemrich G, Russo L, (Eds.), Beyond Relief: Food Security in Protracted Crises. FAO and Rugby: Practical Action Publishing, pp: 127-153.

6. Pantuliano S (2008) Responding to protracted crises: The principled model of NMPACT in Sudan. In: Alinovi L, Hemrich G, Russo L (Eds.), Beyond Relief: Food Security in Protracted Crises. Rome and Rugby: Practical Action Publishing, pp: 25-63.

7. Lokosang L, Ramroop S, Zewotir T (2016) The Effect of Weakened Resilience on Food Insecurity in Protracted Crisis: The Case of South Sudan. Agriculture and Food Security 5(2): 1-8.

8. Pasteur K (2011) From vulnerability to resilience: A framework for analysis and action to build community resilience, Rugby: Practical Action Publishing.

9. IFPRI (2014) Building Resilience for Food and Nutrition Security: Highlights from the 2020 Conference. IFPRI 2020 Policy Consultations & Conference.

10. New Partnership for Africa's Development (2009) CAADP Pillar III Framework for Africa's Food Security (FAFS), Midrand, South Africa: NEPAD Secretariat.

11. African Union Commission (2014) Malabo Declaration on Accelerated Africa Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihood. In Declarations of the 23rd Ordinary Session of the Assembly of the African Union. Addis Ababa: African Union Commission.

12. Slater R (2015) Strengthening Coherence between agriculture and social protection: An analytical framework, Rome.

13. Tirivayi N, Knowles M, Davis B (2013) The interaction between social protection and agriculture: a review of evidence, Rome: FAO.

14. FAO (2012) Resilience Index: Measurement and Analysis model, Rome: FAO.

15. Alinovi L, Mane E, Romano D (2010) Measuring Household Resilience to food insecurity: Application to Palestinian Households. In: Benedetti RR, et al., (Eds.) Agricultural Survey Methods. Chichester, UK.

16. Lokosang L, Ramroop S, Zewotir T (2014) Indexing household resilience to food insecurity shocks: The case of South Sudan. Agrekon 53(2): 137-159.

17. Lokosang L, Ramroop S, Zewotir T (2016) The Effect of Weakened Resilience on 'Double-Risk' of Food Insecurity: The Case of South Sudan. Agriculture and Food Security 5(2).

18. Lokosang L (2015) Flexible Statistical Modelling in Food Insecurity Risk Assessment. Kwazulu-Natal.

19. IBM Corporation (2011) IBM SPSS Statistics version 21.

20. World Food Programme (2014) South Sudan Food Security Monitoring (FSMS) Report, VAM Food Security Analysis, Round 13, Juba.

21. Roberts G, Rao JNK, Kumar S (1987) Logistic Regression Analysis of Sample Survey Data. Biometrika 74: 1-12.

22. Filmer D, Scott K (2008) Assessing asset indices, Washington DC.

23. Department for International Development (1999) Sustainable Livelihoods Guidance Sheets.

24. Gwatkin DR, et al. (2000) Socio-economic Differences in Health, Nutrition and Population in Turkey, Washington DC.

25. Sahn DE, Stifel D (2003) Exploring Alternative Measures of Welfare in the Absence of Expenditure Data. Review of Income and Wealth 49(4): 463-489.

26. Filmer D, Pritchett L (2001) Estimating Wealth Effects without Expenditure Data or Tears: An Application of Educational Enrolment in States of India. Demography 38(1): 115-132.

27. Filmer D, Pritchett LZ (1998) Estimating wealth effects without income or expenditure data - or tears: Educational Enrollment in India, Washington DC.

28. Morris S, Carletto C, Hoddinott J, Christiaensen LJ (1999) Validity of rapid estimates of household wealth and income for health surveys in rural Africa, Washington DC.

29. Momentum (2014) Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods.

30. Flores M (2007) Responding to food insecurity: Could we have done it better? In: Pain A, Sutton J (Eds.), Reconstructing Agriculture in Afghanistan. Rome: Practical Action Publishing.