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FIVIMS SYNTHESIS DOCUMENT

A COMPARISON OF VULNERABILITY ANALYSIS METHODS AND RATIONALE FOR THEIR USE IN DIFFERENT CONTEXTS

FRANK RIELY

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Why Vulnerability Analysis?

Vulnerability analysis (VA) is an important subset of food security analysis. It begins with a more or less static view of the chronic or current level of food security and then incorporates the elements of risk and coping capacity into an analysis that is more forward-looking and dynamic. In the end, VA traces the trajectory of household livelihoods, food access and consumption over successive cycles of relatively good, or relatively bad, economic conditions.

Because of this dynamic perspective, the idea of vulnerability and VA provide a conceptual and analytical framework for linking relief and development activities. With a vulnerability perspective, the concern of food security policy and programs broadens from efforts to address the current constraints to food access and improved levels of well-being, to those that address likely threats to current levels of access and well-being.

The emphasis on vulnerability forces an explicit consideration of both the positive and negative aspects of indigenous patterns of behavior, as households cope and consolidate activities during bad times and recover and expand activities during good times. This perspective ultimately enables the identification of better long-term mitigation activities that minimize the downside of household coping behavior and of better relief activities that maximize the upside of household recovery behavior.

What is Vulnerability?

"Vulnerability" is a concept that is relevant to a number of disciplines: in health and finance, for example, vulnerability can be discussed in terms of the probability of an outcome related to contact with a particular health risk, or, in the latter case, to the probability of a financial outcome as a result of general economic conditions and the particular patterns of investment. Vulnerability has only more recently been applied to the analysis of food security.

According to Robert Chambers, vulnerability represents "defenselessness, insecurity and exposure to risks, shocks and stress ... and difficulty in coping with them." It is, therefore, necessary to define vulnerability in terms of three critical dimensions: vulnerability *to* an outcome, *from* a variety of risk factors, *because of* an inability to cope with those risks.[1]

In the food security context, vulnerability can be defined as:

[1] IDS (1989).

The probability of an acute decline in food access, or consumption, often in reference to some critical value that defines minimum levels of human well-being.[2]

By this definition, vulnerability is a result not only of exposure to risk factors—such as drought, conflict, extreme price fluctuations, and others—but also of underlying socioeconomic processes which serve to reduce the capacity of populations to cope with those risks. Through its emphasis on the implications for basic levels of human well-being, this definition of vulnerability also highlights the important interaction between levels of household food access and the health status of individuals. This interaction ultimately influences the extent of under-nutrition within vulnerable populations and, under emergency circumstances, can determine levels of starvation-related mortality.

This understanding of vulnerability can be summarized as follows:

Vulnerability = Exposure to Risk + Ability to Cope.

In this framework, exposure to risk is determined by the frequency and the severity of natural and man-made hazards, as well as their socioeconomic and geographic scope. The determinants of coping capacity include household levels of human and physical assets, levels of household production, income and consumption, and, importantly, the ability of households to diversify their sources of income and consumption to *effectively* mitigate the effects of the risks that they face at any given moment.

In the end, there is a significant overlap between those households that are currently food insecure and those that are at risk to the type of severe fluctuations in food access that threaten fundamental levels of human well-being. While, in concept, all households may be considered vulnerable, from an operational perspective the primary emphasis of VA will typically be on those households that are already at least periodically food insecure.[3]

What is Vulnerability Analysis?

Again, VA is part of a broader food security analysis, which itself is part of an even broader social welfare analysis. VA can primarily be distinguished from other aspects of food security analysis by its emphasis on the dynamism of conditions faced by households and of their responses to those conditions. However, it is also distinct in that it typically focuses on household *typologies* defined according to both their socioeconomic and geographic characteristics. Specifically, VA places household livelihood systems in a particular social, political, and environmental context that defines not only the risks they face, but also the resource constraints that allow each *type* of household to cope on the downside of a livelihood cycle and better recover on the upside of a livelihood cycle.

There is no one way to undertake VA. A number of different methodologies have been applied to the task, each relevant to a particular dimension of the vulnerability problem and a particular question of strategic and/or operational importance. Differences in the actual methods typically arise out of differences in: (a) the goals of the analysis, which are often not made explicit and

[2] WFP (2000). Preliminary Advisory on Food Security and Vulnerability Analysis for Country Strategy and Country Programme Development. Forthcoming.
[3] WFP (2000). Ibid.

may lead to confusion in the comparison of methods; (b) the availability of data from place-to-place; and (c) the background and preferences of the analysts.

While VA methods can vary substantially, each shares a common conceptual framework. This framework has roots in traditional economic models of rural household consumption[4], it was applied to the problem of famine vulnerability directly as a result of the work of Sen[5], which highlighted the importance of demand-side factors as determinants of famine. It also rests heavily on the work of Reardon and Matlon[6] and others on income diversification strategies in the Sahel and the inefficiencies of food aid targeting based solely on agro-climatic factors. The wealth of literature on household coping strategies has also been important in the development of this perspective.[7]

Uses of Vulnerability Analysis

Table 1 highlights the range of problems that VA has been used to address. In addition to informing early warning efforts, VA has been touted as a useful means to assist in the targeting of both emergency and relief efforts, to support food aid needs assessments and to inform relief and development planning. In fact, more detailed and sophisticated methods to address these various objectives have only begun to emerge in the past five years. While simple narrative analyses have been used to inform many of these efforts, VAs using more formal, quantitative methods are only beginning to address the more modest of those objectives.

Producing the results necessary to meet each VA objective often requires separate types of data and methods of analysis. Therefore, the multiplicity of purposes for VA has bred a multiplicity of VA methods. Combined, that diversity of objectives and empirical approaches often leads to some confusion in discussions of vulnerability and VA methods.

Table 1—Various Objectives Attributed to Vulnerability Analysis

Objective	Uses	VA Approach	VA Methods	Frequency
Context for Early Warning	To derive a qualitative understanding of the proper socioeconomic context for early warning indicator selection and use	An historical analysis of patterns in food access and consumption, as well as the causal patterns of relationships between those outcomes and household risk exposure and coping capacity.	Can be accomplished through a variety of *qualitative* and *quantitative* methods, including a simple *narrative analysis* or the use of *statistical methods* to derive explicit relationships between key variables.	An infrequent analysis is required, to be updated perhaps every 5 years.
Development Program Targeting	To estimate the *relative* severity of food security outcomes over the long-term across regions and socio-economic groups.	Again, an historical analysis of patterns in food access and consumption outcomes, with less explicit emphasis on causal relationships.	Typically accomplished using secondary *quantitative indicators* in the construction of a *chronic vulnerability index*, although recent efforts have	Again, an infrequent analysis is required, to be updated perhaps every 5 years, or according to the duration of the development program cycle.

[4] See Timmer, et al (19xx).
[5] Poverty and Famines
[6] World Development 1988
[7] Seaman and Holt, 1980; Wolde-Mariam, 1984; Longhurst, 1986; Baulch, 1988; Rahmato, 1988; Corbett, 1988; Dejene, 1990; Webb, et al, 1992

			begun to combine more *quantitative and qualitative methods*.	
Emergency Program Targeting	To calculate the *relative* severity of acute short-term changes in food security outcomes across regions and socio-economic groups.	A comparison of historical patterns of food access and consumption to current levels, again, with less explicit emphasis on causal relationships.	Typically accomplished using secondary *quantitative indicators* in the construction of a *current vulnerability index*.	Frequent analysis conducted on an annual or semi-annual basis in disaster-prone areas and otherwise on an as-needed basis.
Needs Assessments	To calculate the *absolute* value of per capita food aid needs across regions and socio-economic groups.	Again, a comparison of historical patterns of food access and consumption to current levels, but with the intent of measuring the absolute gap between current and required levels, rather than a comparison in relative terms.	Requires the use of field assessment methods, either formal, survey-based assessments, or PRA methods that combine quantitative and qualitative information.	Frequent analysis conducted on an annual or semi-annual basis in disaster-prone areas and otherwise on an as-needed basis.
Relief and Development Planning	To obtain an understanding of the causal structure of vulnerability, highlighting sources of risk and determinants of coping capacity in order to identify appropriate areas of intervention to minimize the constraints that households face in their efforts to cope with uncertainty and quickly recover from periods of undue stress.	An historical analysis of patterns in food access and consumption, as well as the causal patterns of relationships between those outcomes and household risk exposure and coping capacity.	Can be accomplished through a variety of *qualitative* and *quantitative* methods, including a simple *narrative analysis* or the use of *statistical methods* to derive explicit relationships between key variables.	Again, a relatively infrequent analysis conducted perhaps every 5 years.

An Institutional Perspective

Existing VA methods have been developed to meet the specific information needs of the various institutions involved. Within the USAID Famine Early Warning Systems (FEWS) Project, for example, VA was initially used to help place its famine early warning indicators in their proper socioeconomic context, as a means to improve the interpretation of those indicators. For FEWS and, eventually, WFP/VAM, the purpose of VA began to evolve from one of developing a more informed basis for predicting severe episodes of food insecurity, to one of targeting the most food insecure and vulnerable populations and of monitoring their progress over time, typically on an annual basis.

Those research questions—targeting and monitoring—and, especially, the institutional resource constraints underlying the FEWS and VAM efforts were the driving forces behind the development of the VA methods summarized in the current FIVIMS document. For each, the primary focus was still on the development of tools for planning emergency operations, but with

increasing spill-over effects for development program targeting. And for each, the methods were developed under the constraints of limited, but technologically savvy, field personnel and easy access to secondary data sources.

For SCF/UK and, later, the Food Economy Group, the food economy approach (FEA) to VA was developed out of the particular field-oriented and operational perspective of the organization, as well as the skill mix of its own analytical staff. The FEA method, therefore, uses rapid assessment methods to focus on a more detailed problem assessment—outlining the causal structure, as well as the overall magnitude of the problem—and, in particular, on an explicit assessment of food aid needs. While less useful for periodic monitoring, the overall approach is an important tool for the planning of both relief and development activities.

The IFPRI CART analysis for Ethiopia was concerned less with predicting socioeconomic and spatial patterns of vulnerability outcomes than the FEWS, VAM, and FEA approaches. It, in fact, took a measure of vulnerability (government estimates of populations in need of assistance) as a starting point for an analysis of the causes of vulnerability using statistical methods and, primarily, secondary data sources. That analysis was intended to address a broad range of policy and operational issues.

Where national governments have different institutional structures and capacities, and, perhaps, different information needs, the optimal approach to VA for national planning purposes might be somewhat different, or encompass various aspects of each of the methods developed to date.

Social vs. Spatial: Which Comes First?

To be completed: In short, the analysis needs to adequately represent both dimensions.

Method vs Understanding: Why Method Also Matters

It is possible to develop a method to measure an outcome, such as malnutrition, that does not yield any understanding of the underlying causes of that outcome—although usually it's better to have at least a rudimentary understanding of the causal pathways that led to that outcome before any attempt at measurement. Even in the world of statistical analysis, causal models and predictive models are distinct.

That objective, to measure outcomes, is a legitimate one in itself, for example, when attempting to measure the prevalence of food insecurity for targeting purposes or in an emergency needs assessment. In the latter context, the issue of *why* coping mechanisms failed is secondary to identifying *for whom* those coping mechanisms failed. In these cases, once a certain level of understanding has been developed on the issue, *the choice of method can be a very important one, since that choice ultimately influences the final estimates of relative outcomes*. For example, the use of MUAC methods typically yields different prevalence estimates than weight/height measures. Similarly, a review of various VA indexing methods indicates that, even using the same set of indicators, different methods for constructing indices can lead to very different conclusions.[8] These differences can have important implications for resource allocation decisions and the success of both relief and development activities.

[8] Riely (1996). Vulnerability Assessment in Ethiopia: A Review of Methodological Issues. USAID Greater Horn of Africa Initiative.

As a result of their particular institutional perspectives, FEWS and WFP have focused their VA efforts primarily on the monitoring of changes in vulnerability outcomes and in targeting populations on the basis of the relative severity of those outcomes, as defined primarily by indicators from secondary data sources. Under best practices, those models should, again, represent a prior understanding of the causal structure of vulnerability, developed through a detailed analysis of information from various primary and secondary sources.

For the analyst, at least, these index methods don't add much to the understanding of the causes of vulnerability. They are useful to assess differences in the severity of vulnerability outcomes and, in particular, to help the analyst communicate the issues to others in a more or less objective fashion. Again, these shouldn't be seen as causal models that help test hypotheses and learn something new about vulnerability, but more as predictive models into which existing knowledge about the nature of vulnerability is integrated in a consistent fashion to better measure relative outcomes.

While FEWS and WFP assessments have always been based on an explicit conceptual framework, the understanding of the specific local structure of vulnerability, how the important variables are "weighted" in any given time and place, has rarely been an explicit topic for FEWS or WFP reporting. The underlying causal structure of vulnerability has always been more or less implicitly understood. This gap has undermined indicator-based VA models somewhat, given the persistent problem of finding appropriate methods to weight indicators.

In contrast, the FEA methodology, which involves a detailed field assessment over a relatively longer period of time, is designed to explore the underlying nature of vulnerability more directly, in addition to generating an understanding of relative outcomes. Compared to the traditional FEWS and VAM approaches, more effort is spent on filling in the details of *why* certain populations are more vulnerable than others, rather than simply demonstrating that they are more or less vulnerable. Indeed, under the FEA approach, the method is largely inseparable from the development of understanding. One weakness of the FEA approach is the inability of field assessment methods to produce a geographically disaggregated view of relative conditions for targeting purposes.

In fact, as the relevance of VA to both relief and development planning has become more clearly recognized, the methods used to assess vulnerability have changed as well from those that simply attempt to measure relative vulnerability outcomes to those that seek to understand the various determinants of vulnerability. While targeting and needs assessment are important dimensions of social programs designed to reduce vulnerability and improve food access and consumption levels, the key to long-term progress toward those objectives lies in a better understanding of the causes of food insecurity and vulnerability. Again, as indicated in **Table 1**, the methods available to develop that understanding can vary from qualitative to quantitative methods. The important aspect of *understanding* vulnerability is to use the information available to tell an accurate story about current levels of food security, the hazards specific types of households face in specific locations, and the factors that constrain their ability to cope with those hazards.

The WFP VAM Unit is currently in the process of undertaking a series of field assessments—Food Insecurity and Vulnerability Profiles—which attempt to reconcile the FEA approach with a broader Household Livelihood Security approach, similar to that used by CARE, DFID, UNDP and others. That field-based, largely qualitative perspective subsequently informs the better use of secondary information in an *analytical process* that incorporates a number of qualitative and

quantitative methods that, combined, are intended to improve policy and programme design for both relief and development purposes.

Inventory of VA Methods

(1) Field Assessment Approaches

(a) FEA-style assessments. FEA applies the structure of the basic economic consumption model to relatively homogeneous regions, or food economy areas, within a country. These food economy areas are defined according to similarities in their production systems, consumption patterns, and other factors. A central feature of FEA is its use of fairly standardized PRA methods to obtain relatively low cost information which is then inserted into a model that mirrors in its basic structure and parameters the more complex economic models of food demand.

The key elements of baseline information obtained through FEA include: (1) the definition of homogeneous food economy areas, (2) estimates of "normal" food consumption levels (in kilocalorie per capita terms), (3) exposure to various risks, (4) background information on coping capacity, including food and labor market behavior, food stock and asset holdings and management, as well as the range and vigor of local social support networks, and (5) identification of consumption and income sources, as well as their relative contribution to the total food budget.

Where relevant, the information above is obtained for specific socioeconomic groups, defined by local informants as poor, modal and rich households in each food economy area. FEA also allows for the quantification of the total population in each food economy area belonging to each socioeconomic group.

The analysis described above provides an important information base on which to assess the causal structure of vulnerability in a socially and spatially disaggregated fashion. That information has potentially important implications for the design of both relief and development activities. In addition, the particular structure of the FEA approach also allows its use explicitly in the estimation of emergency food aid needs.

To estimate food aid needs, FEA field assessments attempt to determine the percentage change in each consumption and income source as a result of a crisis, as compared to the baseline "normal" period. Again, the FEA baseline seems to be expressed in terms of the absolute quantities of food "normally" consumed per capita. Although it is unclear from available documentation, it seems that this baseline is allowed to vary across poor, modal and rich socioeconomic groups.

Total change in food access is a weighted average of the percentage change in each individual consumption and income source, with weights defined by the individual consumption and income shares. In fact, the FEA method allows consumption and income shares to vary within the ranges defined by estimates across normal and bad years.

FEA uses the percentage change in the total food budget, as derived from key informant estimates, as the basis for making quantitative needs estimates. The percentage change in the food budget is apparently calculated for each socioeconomic group and is applied directly to the baseline "normal" quantity per capita to derive an absolute food gap quantity per capita, such that a 10 percent decline in the food budget results in a 10 percent decline in consumption. Total food aid needs are then based on the estimated per capita food gap, multiplied by the total population in each socioeconomic group.

The particular strengths of the FEA method include its focus on homogeneous regions (although in practice these appear to often be defined by political boundaries), use of PRA methods to collect important primary data from the field in a consistent and cost effective fashion, and the algorithm which allows flexibility in the definition of consumption and income shares as a means to understand coping capacity. Because the final results are reported as absolute values of food aid needs, they are directly comparable across regions and over time, an important aspect for targeting purposes. By far the greatest advantage of the FEA approach, however, is the intuitive structure of the model which allows the analyst and policy-maker alike to think through the problem of vulnerability in a very logical and consistent fashion.

On the other hand, at present, the FEA approach application has identified only 16 (or 26?) food economy areas as the basic units of analysis for Ethiopia. At that fairly broad level, the potential for disaggregated geographic targeting is limited. FEA also notes that key informants used to derive consumption and income shares may not be reliable sources of information on certain issues, such as changes in patterns of remittances and other factors which are typically difficult to observe outside of individual households.

Note also that VAM has recently integrated key elements of the FEA approach with the CARE Livelihood Security Assessment methodology into a PRA-based field assessment tool designed to understand the causal nature of vulnerability, as well as its rough social and spatial dimensions. This activity, the Food Insecurity and Vulnerability Profile (FIVP), is currently underway in Nepal and India.

(2) Secondary Information Methods

(a) Simple tabular/narrative analysis.

An often overlooked method of vulnerability analysis is based on a review of existing secondary information sources (from published reports and data sets) and the organization of that information in a form that assesses each aspect of vulnerability in a logical, but narrative fashion. During the rush to develop indices for targeting purposes, the development of background information and documentation of basic assumptions using this approach was typically neglected.

Typically, this form of analysis leads to general conclusions about the causes of vulnerability across broadly defined socioeconomic groups and regions. While an important first step in policy and program design, and in defining the parameters of other analytical approaches, this approach is limited particularly in its ability to provide a highly disagrregated analysis suitable for geographic targeting purposes.

(b) Indicator-based indices

- (i) Z-score indices. The use of a simple index as a tool for understanding various dimensions of underdevelopment is not uncommon and includes the UNDP Human Development Index, among others. In these indices, indicators are typically transformed into common units and simply added across all indicators to produce a final score. This is the approach taken by the FEWS Project in some of its earliest attempts at developing formal VA models in the Sahel region, Kenya and Zambia. The strength of this approach lies in the opportunity to include a variety of indicator types into the analysis.

  However, that strength also leads to the critical weaknesses of the approach, particularly:

- Because the index doesn't directly conform to the structure of the vulnerability conceptual framework, it is often difficult to discriminate between "good" and "bad" indicators to include in the index, which leads to a tendency to include every available indicator in the analysis without fully understanding their relationship to vulnerability.

- In general, the construction of a simple index assumes that every indicator should be positively correlated with the unmeasured concept of vulnerability and, therefore, positively correlated with each other, an assumption which is often violated in VA indices.

- Because the index doesn't directly conform to the structure of the conceptual framework, there are no obvious, objective means to weight indicators according to their relative importance in determining vulnerability. Where a disproportionately large number of indicators are included which represent a single dimension of vulnerability, such as a range of agro-climatic indicators, that dimension may be given undue weight in the final index simply by reason of the number of indicators related to it. This form of implicit weighting risks large biases in the final index results.

- Because indicators used and weights derived may vary between a chronic and a current analysis, the results may not be directly comparable. While this would allow for comparisons of relative vulnerability across regions, the approach makes it difficult to produce an index that is comparable over time.

- Many of the indicators commonly used in z-score indices are derived from national census data and other, infrequently collected data sources. This fact often limits the ability to update the understanding of changes in relative vulnerability levels across strategically and operationally relevant time periods.

- (ii) PCA-weighted indices. Principal components analysis (PCA) is commonly used in the construction of indices for various targeting and poverty mapping efforts in Asia and Latin America and is becoming more widespread in the analysis of vulnerability in Sub-Saharan Africa. Although relatively unknown in economics, PCA is used widely in other social sciences, particularly to explore problems that, like vulnerability, are complex, multi-dimensional and not easily measured directly.

  PCA is typically used to condense a large set of data thought to relate to a particular problem into a smaller set of "principal components" which represent more easily interpretable dimensions of the problem, but which still capture most of the information contained in the larger data set. For example, a hypothetical analysis of vulnerability to earthquakes might condense a range of indicators into a smaller set of dimensions related to geological features, population settlement patterns, and the structural stability of buildings. While PCA doesn't allow for the explicit testing of hypotheses regarding causal relationships, it is an important tool for representing complex issues in terms which are more easily grasped and which can be used to generate questions for further research.

  Each principal component represents a weighted combination of all indicators and explains some portion of the total variation of the original data set. The weights assigned to each indicator are used to define which dimension of the problem each principal component represents—roughly according to which indicators have the highest weights in each combination. Those weights can also be used to construct a synthetic indicator that represents each of the important corresponding dimensions of the problem. The

combination of weights that explains the largest proportion of the overall variation of the total data set, the first principal component, and the synthetic indicator that results from those weights have been used as the basis for targeting decisions in a variety of poverty mapping and related exercises.

The strengths of PCA are that, like the simple index, it allows a large number of variables to be used in the construction of a VA index—including a range of structural indicators related to resource endowments and demographic patterns which aren't easily integrated into the share-weighted index described below—but with greater flexibility for the inclusion of indicators that may be negatively correlated. PCA also improves upon the simple index approach, in that it derives a set of weights explicitly using objective statistical means, rather than being subject to implicit weightings due to data availability or the implicit biases of the analyst. It's widespread use in the context of other targeting efforts and the extent to which the method has been subject to scrutiny in the literature is another particular strength of PCA methods.

The weaknesses of PCA methods include:

- While somewhat simple to use, PCA results are not intuitive. The algorithm used to derive the principal components and indicator weights, although no more complex than standard regression analysis, is unfamiliar and perhaps rightly seen as something of a statistical black box. Unlike regression methods, the weights derived from PCA methods have no valid socioeconomic interpretation for policy purposes.

- By definition, the larger the number of indicators included in a PCA, the smaller the likelihood that the first principal component (which is used to derive the targeting indicator weights) will represent a major dimension of vulnerability that explains most of the variation of the data set.

- Only one set of weights is produced for the entire country, although it is likely that the relative importance of indicators will vary significantly from location to location. It is important to note that this is a weakness primarily in the analysis of a large number of relatively small geographic units.

As with the simple index, because indicators used and weights derived may vary between a chronic and a current analysis, the results may not be easily integrated. While PCA-weighted measures allow for comparisons of relative vulnerability across regions, the approach makes it somewhat difficult to produce an index that is comparable over time

- (iii) Income share-weighted indices. To the extent that secondary indicators can be directly related to specific household consumption and income sources, it is possible to develop an indicator model that mirrors in its logical structure the basic economic consumption model. This approach has been applied in the case of FEWS/Niger (1993), for example, as well as in the recent joint VA effort in Ethiopia. As with the FEA approach, this model begins with estimates of consumption and income shares, often derived directly from available household survey information and supported by other information on occupations and employment. Changes in food access are determined by measured changes in indicators that represent important components of consumption and income. The FEWS/Niger approach simply weights the percentage change in each indicator by its appropriate consumption/income share to derive an estimate of the total change in food access.

This approach is similar in concept and structure to the FEA method, but is less fully developed in detail and relies solely on secondary data rather than key informants for basic information on changes in the rural economic conditions. Although perhaps possible, in the case of FEWS/Niger, the model did not incorporate explicit assumptions of price and income elasticities, nor did it allow for coping by varying consumption and income shares within prescribed ranges. Rather than looking at the observed change in terms of absolute quantities of a food gap, the FEWS/Niger model treated the results as a relative index which offers comparisons of relative changes in conditions across regions for targeting purposes, but not direct needs estimates.

The main advantage of this approach is primarily the intuitive logical structure of the model. Because it mirrors the basic economic model of consumption, it provides a strong guide for the selection of indicators, as well as their interpretation. It could also be altered to include some of the detail of the FEA method, allowing for explicit assumptions regarding price and income elasticities and capturing to some extent the coping capacity of households. Income shares could also be derived for separate socioeconomic groups within each geographic unit, to provide a more disaggregated analysis of vulnerability.

In addition, because many of the indicators used in this analysis, estimates of crop production, food prices, wages, and other outcomes, are collected on an annual basis, the income share-weighted index is particularly amenable for use as an annual monitoring tool and for the geographic targeting of emergency programs. The flexibility of the model allows for easy testing of various scenarios and assumptions, again, producing a fairly transparent set of results.

The disadvantages of the income share-weighted index include:

- While the number of indicators available from secondary sources may be large, there are typically only a very limited number which are directly related to consumption and income sources, or which can be used as reasonable proxies. Very often, for key sources of non-agricultural income, such as seasonal migration, no secondary data is readily available to adequately capture changes in conditions.

- Because the focus is directly on changes in individual sources of consumption and income, the method doesn't easily allow for the integration of a large number of other indicators, including demographic characteristics, market access, or land distribution.

- The assumptions necessary in the use of a large number of proxy indicators for non-agricultural income sources, or the use of other data in developing the assumptions necessary to interpret a more complex index, can quickly undermine the simplicity of the basic model and its intuitive appeal.

- Relating a percentage change in a proxy indicator to an unobserved percentage change in the actual income source depends on assumptions about relationships between factors which are often unknown and untested.

- Where a large number of proxies are used which are reported in non-comparable units, it is often difficult to relate current changes to any comparable baseline index.

(c) Cluster analysis

Cluster analysis has been used by VAM in Senegal and Bangladesh, for example, to produce a descriptive analysis of vulnerability based on secondary data sources. Clustering methods are used to create typologies, or classes, of the reference population, based on the degree of similarity of conditions across units of analysis as defined by selected indicators.

In Senegal, VAM used cluster methods to look at classifications of geographic units. The approach was multi-phased: The analysis began with an assessment of similarities in rainfall and drought patterns across regions, related to known cropping patters, as well as the relative exposure to price variability, contrasted with reliance on market purchases of food. For example, clusters with high exposure to drought and high reliance on rainfed agriculture were contrasted with areas of low drought and high rainfed agriculture dependence, etc., and the results were mapped. The analysis of coping capacity incorporated disaggregated poverty measures, indicators of asset holdings, predicted access to overseas remittances, and other relevant factors to construct another set of geographic clusters. In the end, the assessment of vulnerability overlaid risk clusters and coping capacity clusters. Areas of overlapping high risk and low coping capacity were targeted for particular attention in WFP development operations.

In Bangladesh, VAM used cluster methods on a household income and expenditure data set to identify household groups with similar characteristics across a range of consumption and expenditure-related variables. Again, although based on quantitative statistical methods, the typologies produced were highly descriptive of differences in household groups, and those that should be the major focus of WFP development interventions there.

While cluster analysis does not produce a relative index of vulnerability, the categories defined are highly descriptive of both similarities and differences in and across households and regions. As in Senegal, the use of cluster methods provided some important insights into the causes of vulnerability. In addition, the characteristics of the individual clusters, or typologies, often provided sufficient information for analysts and decision-makers to draw their own conclusions regarding the relative level of vulnerability across clusters. In contrast to the simple index approach, where indicator weights may be similarly subjective, the subjective interpretation of cluster analysis results is transparent and, if done properly, defensible. Rather than the black box of the index approach, where the reasons for a particular outcome aren't readily apparent, cluster analysis opens interpretation of the data to decision-makers in a simple and straightforward fashion.

The negative aspects of cluster analysis include:

- Cluster analysis shares some of the weaknesses of other secondary data methods in that indicator availability is often limited in areas of key concern and data sources are not always updated on a frequent basis.

- Another potential weakness of the cluster method is that the results are somewhat bulky. In contrast to index methods, which produce separate estimates of relative vulnerability for each unit of analysis, clustering methods produce results that can only be interpreted for groups of regions or households. As a result, the use of clustering methods reduced somewhat the ability for a more disaggregated targeting methodology that is often considered to lead to more cost-effective results.

(3) Key Informant Workshops

To be completed:

> Delbecq-Delphi workshops. See Currey in Bangladesh and Borton and Shoham in Sudan.
>
> Other workshop approaches. see FIVIMS. Guidelines for establishing national food insecurity and vulnerability information and mapping systems (Attached). see also VAM National Key Informant Workshop to Support VAM Analytical Activities (Attached) and VAM/Nepal VDC Ranking Methodology (Attached)

Strengths: inexpensive, creates rapid summary of important vulnerability issues, provides opportunity for ownership of analysis at national and local levels, very useful where literature and secondary data are lacking.

Weaknesses: risk of ignoring other important sources of information, biases of key informants, lack of spatial detail (unless working at local workshops), often offers little new insight.

(4) "Conceptual" Mapping

In Yemen, the VAM Unit has recently completed a VA that combines a thorough literature review of food security issues, an analysis of typical secondary data sets, and commonly available spatial data layers available through the internet. Because much of the literature on food security in Yemen emphasizes differences in livelihood systems by elevation/agro-ecozone, the analysis attempted to link descriptive information on livelihood patterns from the literature to a spatially disaggregated view of the country obtain from other secondary sources.

The VAM/Yemen analysis began with the construction of a continuous map of agro-ecological zones (AEZs), with overlays of population density, road and market networks and administrative units. The AEZs were constructed from information on elevation, slope, and attitude; USGS landuse data; rainfall and hydrology (like wadis); among others. These over-layed images were matched to AEZ descriptions found in the literature (which defined elevation cut-offs that distinguished highland from lowland areas in a fashion consistent with descriptive information in the literature).

The overlay of basic AEZs and information on livelihood patterns produced a result based on secondary data that is not unlike the FEA-defined food economy zones. With that basic set of information, the Yemen analysis then developed as set of images related to elements of risk and coping behavior, including an NDVI-based image of drought risk and, in the absence of price data, an image of the relationship of population-to-market infrastructure-to-surplus producing areas that served as a proxy for market risk. Information on areas of civil unrest was also included in the analysis.

In the next phase of the analysis a matrix was constructed of important socioeconomic information from the literature and secondary data sources in a spatially disaggregated format. Much of the information in the matrix relates to various on income sources (differences in food and cash crop production), the location of irrigation infrastructure, areas of high food and cash crop productivity, livestock ownership per capita, poverty levels, among others.

The final analysis of vulnerability in Yemen was actually a conceptual layering of AEZ/livelihood zones, the "hazard" images, and the secondary data matrix, with reference to other qualitative details from the literature. As with the Senegal cluster approach, the Yemen analysis is fundamentally based on a transparent information set and easily defensible logic, not a black box index that hides more information than it reveals. Priority districts still come out clearly in relative terms, just like an index would provide, but the approach also has the qualitative aspect that also informs other aspects of policy and strategy design.

Limitations of the approach include the need to validate the results through field assessment efforts, an undertaking currently under discussion in Yemen, and the high degree of technical capacity required to produce easily-interpretable images of multiple data layers.

Rationale for the Selection of the Right Methodology

The choice of VA methods should not be seen as an "either-or" proposition. Different tools may be used to address different analytical questions at different stages of policy and program development. In fact, it is important to view VA, not as a single methodological approach, but as an *analytical process* that incorporates a range of information types and analytical approaches. At any given point in that analytical process, four main criteria drive the choice for a particular methodology:

(i) the *relevance of information* produced in relation to user needs - the first and most important criterion. For what uses do we need information on who, how many, where and why are the vulnerable and food-insecure? and how immediate is the information need?

(ii) the *financial constraints*. How is the assessment funded and how much are we ready to pay?

(iii) the *administrative capacity*. Do we have the skills, expertise, equipment necessary to perform this assessment?

(iv) the *existing data*. To what extent can the assessment be carried out through the existing data? How much primary collection of information must be undertaken?[9]

As a general statement, VA for development and contingency planning purposes requires much greater detail on understanding the causes of vulnerability, while the development and targeting of social security programs and the assessment of needs for emergency programs require a relatively greater emphasis on methods to measure outcomes.

In addition, for each dimension of any national-level program, information needs will vary over the program and project cycle, from the design phase, through various aspects of implementation, to evaluation and re-design, as outlined in **Box 1**. To the extent that the ultimate objective is to alleviate food insecurity and vulnerability in each of its dimensions, then some type of food security/vulnerability conceptual framework will be necessary to inform the collection and use of information at each stage of the policy and program design and implementation process.

[9] This section is derived primarily from FIVIMS (1999). Criteria for Selecting a Food Insecurity and Vulnerability Assessment Methodology**.**

Clearly, none of the VA methods presented addresses all the necessary information needs for the development, implementation, and evaluation of comprehensive food security policies and programs. As already stated, for the most part, current methods have been designed within a particular institutional context, and primarily to address decision-making needs for emergency food relief activities. The use of these methods has primarily focused on the areas of : (a) problem assessment, (b) needs assessment, (c) targeting, and (d) outcomes monitoring and forecasting. To the extent that information is fungible, these information tools have been adaptable, somewhat, to meet development and contingency planning needs as well.

The following is a brief assessment of the relative strengths and weaknesses of each approach, according to specific decision-making needs:

- *Problem Assessment.* In fact, of the approaches outlined above, the FEA-style field assessment methods and, arguably, the IFPRI statistical method address the issue of problem assessment from the perspective of explicitly examining the causal structure of vulnerability. Both approaches are quite different and yield different, but complementary insights. The cluster analysis methods described in the case of Senegal and the Yemen "conceptual mapping" method approach a degree of insight regarding the causes of vulnerability as well.

Box 1—Information Needs for Policy and Program Design and Implementation

Policy and Program Design Phase:

Problem Analysis
: Assessment of the overall magnitude, important causes, and critical implications of a particular social problem. Must typically begin with a national, cross-sectoral focus, but can be rapidly focused on a geographic, sectoral, and population-specific basis. Can be based on either qualitative or quantitative methods, or both.

Needs Assessment
: Reconciles the set of feasible intervention options with the set of issues identified as being most crucial to the problem of concern. Prioritizes intervention options according potential for impact. Quantifies affected population and level of needs on the basis of the scope and intensity of the problem and the characteristics of the selected intervention.

Program/Project Implementation Phase:

Targeting
: Prioritizes regions/populations on the basis of relative need or expected benefit from a selected intervention, identifies specific members of those priority groups for participation in selected interventions, addresses impact of selected method of allocating benefits on the access/participation of selected regions, communities, households, and/or individuals. Program-level targeting and project-level targeting may be quite distinct and each may be based on multiple criteria and information sources.

Outcomes Monitoring/Forecasting
: Tracking, or predicting, changes in population-level outcomes, either directly or according to appropriate proxy measures, as a form of on-going early warning or problem assessment/needs assessment used to modify activities as necessary during the program/project cycle.

Process/Implementation Monitoring
: Tracking program/project-level activities and outputs via routine reporting mechanisms.

Operational Research
: Analysis designed to answer specific questions intended to improve implementation and overall program/project performance.

Evaluation Phase:

Impact Evaluation
: Determining the causal relationship between an intervention and any observed change in population-level outcomes over the course of the implementation period.

Cost Evaluation
: Assessment of the relative cost of achieving a given change in population-level outcomes associated with various intervention options.

- *Needs Assessment*. Regarding food aid needs assessment specifically, only the FEA-style approach was designed expressly to develop a direct estimate of needs. The IFPRI statistical model and the FEWS/Zimbabwe income accounting approach could potentially be

adapted to provide an indirect needs estimate, which would be more of a model-based forecast rather than a direct measurement of need.

- *Targeting*. The index and income accounting approaches used by both FEWS and VAM are explicit regional targeting tools. In fact, they yield little direct insight into the causal determinants of vulnerability. These targeting tools are useful primarily at the program-level, to determine initial geographic and population-group priorities. At the project-level, such as in supplemental feeding activities targeted according to nutritional status, additional targeting criteria more directly related to the specific objectives of the activity, are also likely to be required.

  The IFPRI method and, to some extent, the FEA-style approach are also useful to identify criteria that might help to prioritize regions and household groups at the program and project-levels. Application of the targeting criteria defined by those methods would require additional data collection efforts to identify specific regions and/or individuals for focus, however. The food economy areas identified by FEA method are generally too coarse for direct regional targeting purposes. Again, clustering methods and the conceptual mapping approach are also useful in the identification of both geographic and socioeconomic priorities at a useful level of spatial detail.

- *Outcomes Monitoring*. The income accounting procedure employed in a number of FEWS (Niger 1993; Zimbabwe current) and VAM (Zambia 1996; Ethiopia/Watkins method) countries is particularly useful for the annual monitoring of changing conditions. Index methods typically rely too much on indicators from a national census and other more or less static data sources. The FEA-style method, as employed in southern Sudan, for example, can also be used to monitor changes in conditions, although in a relatively expensive, labor-intensive fashion (appropriate probably only because it is associated with an on-going relief operation). The approach is primarily a time-intensive, exploratory field assessment, best suited for developing structural parameters, not necessarily for updating changes. Similarly, the IFPRI model provides structural parameters and would require additional information-gathering efforts to produce an indirect forecast of periodic changes.

How Far Does Vulnerability Analysis Go?

While an important starting point, VA does not meet all the information needs in the food security policy and program design process. To the extent that a national food security strategy goes beyond a strict population group focus—into sectoral issues related to agricultural development, natural resource management, microfinance and income support, health and nutrition, and social safety net programs—the analytical needs of that strategy development process go well beyond those addressed by current VA methods.

An appropriate agricultural development strategy, for example, may require an analysis of comparative advantage to explore potential trade opportunities. Also, while vulnerability is often concentrated in areas of low agricultural potential, agricultural planners must look across both high and low potential areas to prioritize investments, perhaps looking for those with strong inter-regional linkages to help reduce vulnerability in those low potential areas where investments in the natural resource base are likely to be unproductive. In the case of national safety net programs—in addition to understanding where the most vulnerable are located—an analysis of the demand elasticities of vulnerable households may also be required, as the basis

to identify and price any inferior commodities that might best be the focus of a self-targeted food subsidy program.

Again, these activities suggest a set of analyses that go well beyond the scope of current VA methods. Indeed, an emphasis on vulnerable groups only goes so far. How that population-specific emphasis should be reconciled with cost-effective sectoral investment strategies has itself yet to be adequately addressed.

To support the full development of national food security strategies, it is important to first identify the specific information needs required to answer key questions at every stage of the policy and program development process, and across every relevant sector. Food security policy development requires a *roadmap of decision-making needs* for which specific data sets and analytical methods must be developed within the context of each country.

Too often, the development of information systems -- early warning systems, vulnerability assessment systems, and monitoring and evaluation systems, for example -- begins with a process of inventorying indicators and with data base development, without a critical assessment of actual information needs. Clearly, while most countries gather much useful information, much of the data available are of very little value (and are often left unused by those who collect them), and there remain important gaps in the available information set. Without a clear guide that defines the information required for policy and program formation, the resulting data bases are of uncertain value.

Also, too often, the tools and information products developed under these information systems reflect more the training and interests of the analysts, rather than decision-making requirements at the policy and program level. There is clearly an essential need for greater dialogue between analysts, on the one hand, and policy and program decision-makers, on the other hand, to ensure that information products speak more directly to operational needs. This dialogue could be significantly guided and improved by the development of the information roadmap discussed above.

Instead of focusing its efforts on methods and indicators, FIVIMS should facilitate a process that can match analytical approaches with both national decision-making needs and, in particular, national institutional capacities. As a basis of that facilitation process, FIVIMS should first define a “roadmap” of priority information needs at each stage of the food security policy and program decision-making cycle: identifying explicitly *what* information is needed *when* and *for what purpose*—rather than leaping to indicators, data bases, and methodologies.

An explicit roadmap of priority decision-making needs would also provide for better and more cost-effective information system planning, helping to prioritize information needs, avoid unnecessary investments in information, and more readily exploit complementarities in data gathering and analytical functions. It would allow for better communication between decision-maker and analyst, as well, leading to more operationally relevant outputs. Finally, such a roadmap would serve to identify current gaps in the available methodologies and help guide investments in methodology development in a more rational and cost-effective fashion.