ROUND TABLE ON MONITORING FOOD SECURITY

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Measuring food insecurity: meaningful concepts and indicators for evidence-based policy making

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INTRODUCTION

This Round Table has been called for by the Committee on World Food Security (CFS) to review and to discuss methods for "measuring hunger." Appropriate mechanisms to monitor hunger and food insecurity are essential for food security policies and programmes. However, finding agreement on objective assessments of food insecurity presents significant challenges to analysts and to policy-makers.

This paper frames the issues and controversies to be discussed during the Round Table on Monitoring Food Security; contributing to the objective of reviewing the merits of different methods to asses food security (including the revised FAO methodology), to solicit the opinions of experts from institutions and countries, and to identify the evidence-base for more effective food security policies.

The paper is organized as follows: Section 2 discusses definitions and ways to assess different forms of food insecurity. Given that there are so many *operational definitions* of food insecurity that are contingent on the *breadth* and *depth* of the situation being analysed, alternative indicators are meaningfully comparable only inasmuch as they refer to the same operational definition. No single indicator will likely suffice in providing a comprehensive picture of the problem (a conclusion already reached on several occasions, see for example De Haen, 2003). Rather, a carefully chosen suite of indicators is likely necessary to describe food insecurity in all its dimensions that will reliably inform the international community and national authorities in designing appropriate response. The problems of how to select an optimal set of indicators and how to synthesize the information they carry will also be briefly discussed.

Section 3 focuses on the country-level indicator that is routinely calculated by FAO and published in the State of Food Insecurity (SOFI) to measure the *Prevalence of Undernourishment*. The objective of the session will be to address various concerns that have been raised on the proper interpretation and potential usefulness of this indicator. The aim is to explore ways to improve its accuracy, timeliness and responsiveness to changing economic and social conditions and to present activities that FAO is engaged in its meaningful derivation.

In discussing possible improvements to the FAO indicator, the crucial point will be made that, no matter how sophisticated and theoretically sound a methodology is, the reliability of the indicator depends on the quality of the underlying data. This issue introduces the theme of section 4, on the need to enhance the capacity of countries to collect and validate basic data on production, trade and storage of food, both at national and household level. The efforts that are currently being made by FAO to assist countries in developing capacity in the field of agriculture, food and nutrition statistics will be briefly reviewed. One important outcome of the Round Table discussions will be spelling out the capacity needed to effectively monitor food security.

DEFINING AND MONITORING FOOD SECURITY

In recent discussions, terms such as “hunger”, “food insecurity”, “undernourishment”, “malnutrition”, “food deprivation”, “food crisis”, are used interchangeably as if they were synonyms. Yet, they are not. Each term carries its own connotation, and recognition of the differences in terminology is equally important to an understanding of how a specific indicator is calculated. The variety of terms that exists is in itself a recognition of the fact that food insecurity is a *multi-dimensional* phenomenon.

When the international attention was first directed to the problem of “hunger”, the term mostly meant the incidence of famine and the resulting deaths from starvation. The immediate cause of starvation was identified as a lack of sufficient food, and “ensuring food security” was interpreted as providing an *adequate supply* of food to those in need. The limitations of this interpretation were immediately evident. For instance, the disconnect between the success in increasing food supplies through improved agricultural production and the persistence of hunger and malnutrition around the world revealed the limits of a concept based only on availability of food.

Since then, attention has shifted towards the *access* dimension as a key determinant of food security: Enough food may be available at the aggregate level, but the way in which individual households obtain access may not be equal, with some households not being entitled to sufficient food while others have more than needed. There is now a wide recognition that neither availability nor access alone would suffice in adequately defining food security and consequently *utilization* was added as a further dimension. Effective utilization captures the efficiency of the nutritional process in terms of nutritional status, and food security had broadened to include a new dimension of nutritional concerns. This shift of focus —in part the result of progress in increasing worldwide food availability— occurred over a relatively short period of time, during which newfound impetus has been placed on the need to improve and broaden the set of tools used by researchers and analysts to monitor the phenomenon, and in improving policy guidance by assessing the impact of alternative intervention.[1]

The need for a set of indicators

Given the preceding considerations, it is not surprising that no single metric could conceivably capture the complexity of Food Security. The resulting proliferation of indicators that has emerged over the years, however, brings perhaps unnecessary complication. Already in 1999, a review of available indicators listed up to 200 different definitions and 450 indicators (Hoddinott, 1999), and is very likely to have increased since then. The question remains how to choose among them?

[1] The development of the concept of food security and the proliferation of suggested indicators is illustrated well in the seminal contribution of Maxwell and Frankenberger (1992), which lists 194 different studies on the concept of food security and 172 studies on indicators. By 1999, Hoddinott (1999) was able to list approximately 200 definitions of food security and 450 indicators.

To the aim of evaluating the comparative values of alternative indicators, the scope of the analysis and its depth should be preliminarily defined. One possible framework includes the following elements:

A) Scope or breadth of the analysis

1) Attention given to the causes of the food insecurity (limited availability or access) or to the consequences (nutritional status, economic and social cost, welfare reduction)

2) The people involved, intending both the number and social organization, characterizing situations ranging from individual food security status within a household, to that of groups of people as households, villages, towns, provinces, or countries.

3) The time length over which the food insecurity condition spans, ranging from acute situations one or few days, to a period of several weeks, months or years.

4) The actual or potential nature of the situation (that is, the degree of uncertainty surrounding its possible manifestation.)

B) Depth of the analysis

5) The characterization of the problem, measured in quantitative terms (i.e., food production deficits, energy intake deficits, etc.)

6) The qualitative nature of the problem, (e.g. whether it refers to a "diversified" diet, or to the need to acquire food in "socially acceptable" ways or any other qualitative characterizations)

In principle, any combination of values or of ranges of values for the six elements in the above framework could yield one particular *operational* definition of food insecurity, for which an "optimal" indicator could then be found.

Once a solution is found on the proper definition, assessing the comparative value of an alternative indicator poses other problems related to the fact that there is no "objective" measure to take as reference. Alternative indicators have been compared often without paying due attention to the different implicit definitions of food insecurity to which they correspond.[2] Recognition of these differences may lead to the conclusion that the food

[2] For example, the value of a self -reported assessment of food security has been compared with measures of the household's income, nutrition or food intake (Coates, Webb and Houser, 2003). Migotto *et al.* (2007) compare measures of household calorie consumption, total expenditure, dietary diversity and anthropometry with answers to subjective consumption adequacy questions, to find that "overall calorie consumption, dietary diversity and anthropometry are at best weakly correlated to subjective perceptions of food consumption"; and that " 'subjective' and 'objective' indicators do not classify the same household as food (in)secure)" (Migotto *et al.*, 2007, p.30)

security situation of a country would be best profiled through a suite of indicators rather than any single one in isolation.[3]

Synthetic indexes of food security[4]

Even though several indicators may be available to illustrate the "profile" of food security, encompassing different dimensions, policy-makers are often requested to *rank* the analysed entities (households, countries, regions) to measure the general extent of food insecurity. Ranking is particularly needed for the design and targeting of food security policies. Ranking implies assigning a value to a single multidimensional composite index, which is then used to summarize the information contained in the various component indicators that are aggregated. Not without considerable reservation, it is common practice to adopt this approach in the policy arena.[5]

At the same time, denying the practical usefulness of deriving a single food security scale would not be helpful given the fact that policy choices inevitably imply the need for prioritization, especially in the context of targeting and implementation. Moreover, single food security scores can be useful in analytical work aimed, for example, at studying the determinants of food security, or in quantifying the impact of food security programmes. It may thus be appropriate to ask whether there are means to undertake ranking in a better, i.e. more transparent and robust, way. The following discussion presents some of these issues.

With reference to food security, several single-valued aggregate indexes have been proposed, both intended for use at the aggregate, macro-level (i.e., to rank countries or regions), and at the micro-level (individuals or households). Proposed macro-level indexes of food security include the *Global Hunger Index* (GHI), introduced by IFPRI, the *Nutrition Index* (NI) developed by Weismann et al. (2000), the *Hunger Index* (HI) published in 2001 by the Bread for the World Institute, and finally the *Poverty and Hunger Index* proposed by Gentilini and Webb (2008). Micro-level indexes which have been discussed in the literature include, *inter alia*, the *Aggregate Household Food Security Index* (AHFSI) developed by the

[3] Rather than attempting to reject one indicator as inferior to another, an analysis of the structure of correlation that exists among various indicators, for example by factor analysis conducted over a data set comprised of various indicators collected on the same observation units (i.e., the same country over the same period of time), may be helpful in discovering whether:

a) there indeed exists a set of underlying independent "dimensions" that are being captured by the set of measured indicators;
b) a subset of the indicators are "redundant" in the sense that they are so highly correlated with others that they do not carry any additional information; and
c) there are ways of combining the different elementary indicators that are routinely fed to complex indexes that reveal the underlying dimensions of food security.

Such analysis is currently being conducted at the FAO Statistics Division. Through the analysis of a database of 77 indicators collected over the period from 1990 to 2009, for 181 countries, results are expected to inform the selection of the most efficient suite of indicators that characterize the food security profile of countries monitored in the SOFI publication.

[4] This section draws heavily on Aurino and Cafiero (forthcoming).

[5] Composite indexes are used also in other policy fields. Among those closely related to food security, there are two that deserve mention: poverty (see for example Alkire and Santos, 2010) and countries' economic vulnerability to shocks (Briguglio et al., 2008). For a critical view of the use of multidimensional composite indexes, see Ravaillon (2011). Although many of the arguments raised in this literature are of interest for the issue discussed here, a review of those contributions goes beyond the remit of this paper.

FAO in 1996, Christiansen and Boisvert's (2000) *Food Security Index* (FSI), the *Composite Index of Anthropometric Failure* proposed by Svedberg (2000) and the *rural household Food Insecurity Index* (rurHFII) of Burchi and De Muro (2007).[6]

The two conceptual steps involved in the creation of a multidimensional index are: *identification* of the relevant dimensions to be included in the analysis (i.e., selection of the most appropriate *informational base*) and their *aggregation* (Sen, 1976, 1999).

In the identification step, ideally *all* and *only* the relevant dimensions would be included (that is, to exhaust the range of relevant dimensions while avoiding redundancy). As discussed in the previous section, this may be problematic due to the complexity and the "fluidity" of the food security concept. The degree of subjectivity may be reduced by recourse to multivariate statistical analysis conducted on the wealth of collected information that is available, and letting to a maximum extent possible, the data to reveal the relevant underlying dimensions.

More problematic appears the task of reducing the degree of subjectivity in the aggregation step, which amounts to assigning arbitrary weights to the constituent indicators that measure the selected dimensions of the aggregate index. The usual practice of assigning equal weights to the selected components is as arbitrary as any other choice, and is questionable on the account that decision-makers may have different views of the relative importance of the various components when measuring overall food security.

One possible analytical route that could be explored is the use of "preference elicitation techniques" developed in the field of multi-criteria analysis, such as the Analytic Hierarchy Process of Saaty (1980). This technique is based on expert judgment on the relative importance of various criteria (in this case, the various individual dimensions as captured by the single indicators) as expressed by pair-wise comparisons. The results of the comparisons are then consolidated in a set of weights to be assigned to the individual component to construct an aggregated index. Given the structure of the preference elicitation process, AHP makes the determination of the weights more transparent thus facilitating discussions among experts on the appropriate set of weights.

MONITORING HUNGER AT COUNTRY LEVEL

In this section we focus on the FAO indicator of *Prevalence of Undernourishment* (PoU), to discuss its merits and limitations.[7]

A general concern in using the FAO indicator relates to the gap that appears to exist between the statistical measurement and the public perception of the status of food insecurity in the world.[8] The gap may result from two different sources: one relates to the

[6] For a more comprehensive review of these indexes, see Aurino and Cafiero *cit.*

[7] The motivation for doing so stems from concerns and criticism that have been raised against the FAO indicator (for example Svedberg, 2000). The FAO has always taken concerns and criticisms seriously, and this Round Table continues such a tradition.

[8] In analysing a similar state-of-affairs with respect to the measurement of economic progress, three prominent economists recently found that (Stiglitz, Sen and Fitoussi, 2009, pp. 7-8) "there are several explanations for such a gap [among which]:

adequacy of what the indicator is set to measure, i.e. what *operational* definition of "hunger" or "food security" the indicator informs; while another refers to its qualities, i.e. statistical validity, given that the underlying definition of "hunger" is understood and accepted as valid. Obviously, valid criticism can be raised on both aspects, but treating them separate can facilitate the discussion.

In what follows, the FAO indicator will be described with the aim of clarifying first the *statistical concept* that it seeks to inform, followed by a description of the way it is *implemented*. The goal of this account is to facilitate the debate on improving the monitoring of progress and failures in the fight against hunger. We are also seeking suggestions on possible improvements to the FAO indicator, and its possible integration with other conceptually different measures.

The FAO methodology to assess chronic undernourishment

The FAO indicator is obtained as an estimate of the proportion of people in a country that most likely suffers from chronic undernourishment. The term *undernourishment* (also referred to as *food deprivation*) indicates the condition of not consuming, on average over an extended period of time (usually a year), an amount of dietary energy sufficient to cover the minimum requirements for a healthy life.[9]

The calculation is an exercise in model-based statistical inference: A probability distribution model is assumed for the annual average dietary energy intake of a representative individual in the population and its parameters are estimated on the basis of the best available data. Required data include: (a) the total availability of food in the population, (b) the demographic structure of the population (by sex and age-classes), (c) information on the distribution of food access within the population, and (d) a normative level of minimum dietary energy requirements to set a lower bound of adequate nutrition. Once the probability distribution is characterized and the threshold is set, the proportion of the population that is likely suffering from chronic food deprivation, *PoU,* is estimated as the probability mass that falls below the threshold.

The concept of Food Security covered by the FAO indicator

Formally, the *PoU* expresses the probability that, by randomly selecting one individual from the population, a person will be found to consume (on average and over a lapse of time) a level of food energy below the minimum required to maintain a healthy life. The operational definition of food insecurity that is embedded in this indicator is best labelled as "*chronic undernourishment in a population.*" Following the framework, it can be described by:

A) Scope or breadth

1) Focus on *access* to food as the determinant of food insecurity

- The statistical concept may be correct, but the actual measurement process may be imperfect
- There may be debates about what are the right concepts, and the appropriate use of different concepts"

[9] Comprehensive descriptions of the FAO methodology for estimating the extent of food deprivation can be found in Naiken (2003), FAO (2003), and in Sibrian, Naiken and Mernies (2007).

2) Reference *population* (usually a nation, though it can be applied also to regions or sub-national populations)

3) Reference to an extended time span of the food insecurity condition, i.e., a *chronic* situation

4) Aiming to measure the *actual* experienced conditions as assessed *ex post.* No considerations of risk are included

B) Depth of the analysis

5) Measure of a *proportion* (on a scale from zero to one) or *number* of people within the population which are likely to be below a minimum threshold level. Even though quantitative, it is a *probabilistic measure*. As such, it should always be understood as potentially affected by statistical errors.

6) Describing food as *dietary energy* thus neglecting other possible qualitative dimensions of food intake.

Such an operational definition is admittedly limited, as it is not meant to capture those dimensions of food insecurity that may be just as important as the ones included. Its major limitations are the following.

- Though the concept relates to an individual condition, the indicator is designed to measure hunger at the level of a population. Its calculation does not depend on the possibility of collecting data on individuals, nor is the indicator intended to be used to assess the undernourishment condition of any specific individual or group of individuals in a reference population.[10] Therefore, it does not capture possible idiosyncratic, individual problems in accessing food.

- The fact that the reference period is taken to be a year, means that the indicator cannot capture temporary, short lived situations of food stress. These may include short term food price crises, whose impact is captured only to the extent that they determine longer term changes in food intake habits of a population.[11]

- By focusing on food access, it does not reflect cases of *malnutrition* associated with factors related to the efficient utilization of food.

- Similarly, it misses the "quality" dimension of food security, for example micro-nutrient deficiency and related morbidity.

- Finally, by focusing on a determined period, the indicator misses the dimension of risk and vulnerability associated with the (in)stability in the access to food.

[10] Though the reference population is usually taken to be that of a nation, the method can be applied to sub-national populations, provided data pertaining to such sub-populations are available, see Sibrian (ed., 2008).
[11] This limitation, however, is consistent with the fact that in the short-term many mechanisms exist (food item substitution, use of savings or credit, etc.) for households to cope with temporary food price crises while maintaining energy consumption at levels.

All these considerations further highlight the need for combining information from more than one indicator in assessing food security, as discussed in section 2. Such a set of indicators could, for instance, include anthropometric measures and economic indicators such as disposable income and food prices. These additional indicators can play an important role in describing the food security situation or in designing food security policies, but they do not undermine the validity of the FAO PoU indicator.

Practical implementation

Implementing the statistical concept just described requires a set of *ancillary assumptions*, mostly driven by feasibility and data availability constraints. The current practice at FAO is based on the following:

(i). Food intake is approximated by quantities *available* for consumption, with no consideration of household-level food waste.

(ii). The distribution of food available for consumption is analysed at the household level, therefore possible unequal distribution of food within the household is ignored.

(iii). The minimum dietary energy requirement (MDER) is defined at the population and not at the individual level.

(iv). The distribution of average individual dietary intake in the population is assumed to be Log Normal.

The first two assumptions are conditioned by data availability: Though measures of actual intake could be obtained from nutrition surveys, the vast majority of available data sets on food consumption do not allow for a precise estimation of household food waste. Similarly, data from very few and recent surveys could allow an analysis of the intra-household distribution of food consumption.

Assumption (iii) is more substantial. It is derived from the consideration that food energy requirements can be safely defined only in terms of a *distribution within a given class or population group*, not at the individual level (FAO/WHO/UNU, 2004). This implies that classification of single individuals as undernourished based on comparison of the level of habitual food intake with their individual requirements is problematic, as the latter cannot be usually estimated with sufficient precision.[12] A minimum level of dietary energy intake which is compatible with a healthy and productive life can nevertheless be meaningfully defined *in a statistical sense* with reference to the representative individual in a group or class.

Assumption (iv) on the statistical model used to conduct the inference at the population level is, admittedly, the shakier among those currently informing the implementation of the procedure.[13] It has been informed essentially by analytic convenience, which suggested

[12] If one has information on an individual's Body Mass Index and level of physical activity, requirements at the individual level could be assessed more precisely, as FAO is currently experimenting with help of epidemiologist for Guatemala.
[13] Though, interestingly enough, it has rarely been singled out by external critics.

search for a flexible, yet parsimonious statistical model. The Log Normal was chosen, during the preparatory work for the 1996 World Food Survey, due to some desirable characteristics (it is positive valued and with an elongated right tail) and the parsimony in the number of parameters needed for its characterization (only two: a "location" parameter and a "dispersion" index). The Log Normal model was tested against two alternatives (a Normal and a Beta distribution) and showed a vastly superior fit of data from a limited number of datasets on individual food consumption. Nevertheless, there are legitimate concerns that the Log Normal model may be not flexible enough to capture changes in the distribution of food access, especially if such changes affect the two "tails" of the distribution in opposite ways. For this reason, FAO's Statistics Division is currently exploring alternative models that afford greater flexibility in representing the distribution of food consumption (see below).

Finally, a set of decisions needs to be made on the *estimation criteria* and the *data* to be used in order to produce an actual estimate. The crucial aspects, in this context, are the estimation of the parameters for the distribution of food access across a given population, and the level of food consumption taken as a threshold. Three major sources of data are used:

1. Demographic data on population characteristics, as provided by official sources (UN Population Division, US Aid Demographic and Health Surveys – DHS, etc.)

2. Assessments of country level food availability, as reported by the FAO's *Food Balance Sheets* (FBS) (http://faostat.fao.org/site/368/default.aspx) compiled for a large number of countries in the world, based on official data for production and trade, as well as on estimates of food and non-food uses of the major commodities.

3. Data from nationally representative household income and expenditure surveys containing information on food consumption.

The **demographic data** are used to calculate the food availability per capita and the MDER. Estimates of the sex-age structure of the population for all countries in the world are released every two years by the UN Population Division, and promptly used to revise, when needed, the estimates of the PoU.

FAO's **Food Balance Sheets** (FBS) are a source of information on the total availability of food in a country in a given year. In principle, they should include all food sources: produced, imported or otherwise made available (i.e., through food aid). The total supply of each food source is converted into dietary energy, and an estimate of the per capita Dietary Energy Supply (DES) is obtained by then dividing by the country's population (FAO, 2001).

DES numbers obtained from FBS have been typically used by FAO as the preferred source for estimating the mean of the distribution of dietary energy consumption. Advantages of this choice are that the FBS are routinely produced by FAO for a large number of countries using a common methodology. Problems are associated with the reliability of the underlying official data on production, trade and the extent of non-food use. While concerns can be raised on the reliability of various elements of the FBS, the resulting estimate of the mean total dietary energy supply can be more precise than each individual component, owing to the fact that errors in various elementary components may cancel out with aggregation. An

issue that raises concerns about the prospects of systematic errors being introduced in the mean food supply, pertains to storage. Storable commodities, such as grains, contribute towards a large share of total food availability in many countries, and failing to accurately capture inventory changes will undoubtedly affect the precision of DES in any single year. This, however, is thought to be circumvented on the assumption that errors in the measurement of stock variation would be removed through averaging, the reason why official values for the prevalence of undernourishment have been published until now only as three year averages. Efforts are currently underway to estimate levels and changes in food stocks more precisely, in addition to several other improvements, which are expected to provide a set of enhanced FBS estimations by 2012.

National level **Household Surveys** (HS) are virtually *the only* source of available information to assess other parameters of the distribution of food intake[14] and, in principle, could also be used to estimate the mean DES in the population, though care must be taken to ensure the completeness of the data.[15]

When using household survey data to assess dietary energy consumption, care must be devoted to three major issues: First, when surveys do not report the actual quantities of food consumed, values need to be estimated by converting monetary expenditures into quantities, which in turn are converted into calorie equivalents (this is particularly relevant for expenditure on food consumed away from home). Second, to increase reliability of the reported data, the consumption of food is commonly referred to a short period (usually a week or a fortnight); in such cases, procedures must be devised to correctly project them on to the household daily average level of calorie consumption over the longer-term. Third, when the quantities or expenditures being reported refer to food acquired during the reference period, and not necessarily consumed, efforts should be made to adjust them for possibly systematic discrepancies between acquisitions and consumption as induced, for example, by varying food prices.

As a precaution against possible biases in the estimation of the PoU due to the difficulty in controlling for the problems listed above, HS have been used so far only to estimate the dispersion of food consumption in the population. It is hoped that in the near future, better data and more complete information on the distribution of food consumption will be available for many countries to allow improving the precision of the PoU estimates.

Criticisms and scope for improvement[16]

The FAO index of undernourishment has been the subject of criticism. Two major criticisms are those from Smith (1998) and from Svedberg (2000, 2002).

[14] For countries for which no household surveys were available, FAO had to devise indirect means to estimate the parameters of the distribution, by referring, for example, to tabulations of income distribution and to other indirect indicators of food consumption dispersion.
[15] Sizeable discrepancies have been occasionally observed between the per capita availability of food as estimated from FBS and from HS on the same country. In addition to different levels of reliability, disagreements may be due to the ex/inclusion of food away from home in HS, and the non-household consumption of food (schools, jails, etc.).
[16] See also Cafiero and Gennari (2011).

According to Smith (1998, p.434), the way in which FAO estimates the number of undernourished would be affected by a "methodological bias in favour of food availability" because of the tendency not to update the coefficient of variation of the food consumption distribution. This has created an impression that the FAO indicator is, essentially, a metric of food availability.[17] As noted before, however, the PoU reflects both availability and access, as it could not be calculated without considering the distribution of food consumption within the population.

Unfortunate as the practice of not regularly updating the CV may have been (due to lack of data first, and to difficulties in properly processing the available surveys later), it must be noted that this is not equivalent to maintaining the distribution of food access unchanged. When mean consumption is updated while leaving the CV fixed, implicitly the inequality in food consumption is also altered, as a result of the Log Normal distribution assumption. Actually, this is a criticism that can be raised against current FAO practice, namely the unintended change in the distribution of food access that occurs when updating mean food availabilities. Smith's criticism is based in the assumption that as income increases, mean food consumption should increase at the same time as food consumption dispersion should fall as a result of the well-observed declining income elasticity of food demand[18]. In any case this is an empirical question that can be settled with the increased use of household surveys.

A second widely levelled criticism is that the FAO method might generate systematically *upward biased* estimates of the level of undernourishment as a result of ignoring that energy requirements and food consumption are correlated (Svedberg, 2000, 2002). However, as pointed out by Naiken (2002, 2007) and reiterated in Cafiero and Gennari (2011), the criticism is based on an improper interpretation of the statistical concept underlying the FAO methodology. The assumption of a joint continuous distribution for individual intake and requirement, as employed by Svedberg in presenting his argument, is inconsistent with, and therefore cannot be applied to, the parametric model of the representative consumer that forms the basis of FAO methods.

In a commendable effort of suggesting improvements to the current FAO methodology for estimating the prevalence of undernourishment, an IFPRI report (Smith, Alderman and Aduayom, 2006) suggested a methodology fully based on the analysis of household consumption surveys. In this report, the authors suggest a method that does not rely on a parametric model to infer the prevalence of undernourishment, but suggests that better estimates could be obtained by a conceptually much simpler method based on the headcount of households classified as food insecure in the sample.

[17] For example, a recent report commissioned by the UK Government Office for Science described the FAO indicator as "based on food balance sheets, adjusted for income distribution", and then terms it as a "crude supply-side measure" (GO-Science, 2011, p.4). Another example of how the foundations of the FAO methodology are poorly understood is given by the "Hunger notes" web-site (www.worldhunger.org) which up to a few weeks ago, used to describe it as follows: "It looks at a country's income level and income distribution and uses this information to estimate how many people receive such a low level of income that they are malnourished. It is not an estimate based on seeing to what extent actual people are malnourished and projecting from there (as would be done by survey sampling)." Thanks to the sensitivity and willingness of the World Hunger Notes editor, the error is now corrected.

[18] This point is elaborated below in the discussion of possible improvements to the FAO methodology.

The IFPRI report has received a significant attention by the profession (De Haen, Klasen and Qaim, 2011), and it has been recently quoted to suggest that the FAO procedure for estimating the number of undernourishment may lead to biased estimates (see for example GO-Science, 2011). However, this claim is unfounded, as the results of the IFPRI report are based on a comparison of the households' food consumption with the *median* requirement of the reference group, and not with the *minimum* requirement as the FAO does.[19] Further, as argued by Sibrian, Naiken and Mernies (2007), the proposed non-parametric approach to estimate the prevalence of undernourishment, even if corrected for the proper definition of the household reference requirement, does not yield improvements over the current method, unless the quality of the data collected in the surveys allows to measure *usual* food consumption, and all sources of food consumed are surveyed.

The major attractiveness of household surveys data is that they may, in principle, allow the linking of the undernourishment status to other household characteristics, thus permitting a more detailed analysis of possible determinants of undernourishment. For this reason, efforts need to be put in improving the design and implementation of food consumption surveys, and to develop appropriate methods to validate and process their data.

The way forward

This discussion so far has served the purpose of highlighting the strengths of the statistical concept informing the estimation of the PoU and some of the challenges that still need to be overcome in the actual measurement to produce reliable estimate for all the countries being monitored. To progress move forward in this direction, activities are being conducted both to refine the statistical model and to improve the quality of the underlying data.

Improving the underlying probabilistic model

A thorough revision of all the available HS data is being conducted in order to update the parameter estimates for all countries for which new surveys have been made available in recent years. One important outcome of th revisions will be the provision of improved data for conducting new tests on the probability distribution assumption. Choice of the best probabilistic model to represent the distribution of DEC in the population must confront the fact that there exist no census data of DEC in a population that could be used as a benchmark. As repeatedly indicated, data in nationally representative HS can be used, but care must be taken to purge them from the effect of unwanted variability (for example due to seasonality and short reference periods). Lacking adequate benchmarks, choice of the model distribution must be informed by the careful consideration of its flexibility against the number of parameters needed for its full characterization. Several families of distribution are being considered, such as the Log Normal, the Beta, the Skewed - Normal and the Skewed-*t*.

Consolidating different sources and improving the quality of the underlying data

The existence of different sources to estimate dietary energy consumption, namely HS and FBS sheets provides the opportunity to cross-check the quality of the underlying data. Comparison of the level and composition of the average per capita supply of dietary energy

[19] For a discussion, see Sibrian, Naiken and Mernies (2007)

can be a fruitful way to identify possible incompleteness in the compilation of FBS and an alternative estimator when important weaknesses can be identified. Furthermore this cross-checking also provides guidance on how to direct efforts to improve the quality of the underlying data; for example, underestimation of production of certain goods in FBS, or incomplete food questionnaires in HS. Success in such an endeavour requires a continued action by FAO and other concerned institutions in assisting countries in improving their capacity to collect, to validate and to process data on food production and distribution. How to obtain that is the subject of the next and final section in this paper.

MEETING DATA REQUIREMENTS THROUGH NATIONAL CAPACITY DEVELOPMENT

A challenge arises in matching the prerequisites of accuracy, relevancy and comparability in food security measurement with the required capacities of countries to fulfil data needs. The quality of an indicator rests on the reliability, accuracy and timeliness of the basic data and information used to compile it. Only with these attributes can the many dimensions of food security be effectively monitored. The availability and access to a wide-ranging pool of reliable basic data and information is critical for the design and application of the aforementioned methodologies and models.

Inroads have already been made. In recent years, FAO has been working with its partners to develop comprehensive and coordinated information systems for food security. Complementary initiatives and strategies are underway to develop universally accepted and country-owned food security and analysis systems, including standard methods and tools for generating food security information and building countries' capacity. The same comprehensive and strategic approach is also being undertaken to address basic data requirements and to build sustainable statistical systems at the country level. Both the improved basic data and the country-owned food security analysis systems ultimately aim to (i) broaden the range of food security measures towards a suite of indicators and (ii) improve the accuracy of the existing indicators, notably the FAO PoU indicator. The following and final section of this paper will present some of the most important initiatives that have recently been launched to reach these goals.

Information Systems for Food and Nutrition Security (ISFNS)

The need for a comprehensive approach towards improved food security information has given rise to the creation of an overall umbrella programme under which the various activities in the area of food security monitoring and capacity building are being coordinated. This umbrella is known as "Information Systems for Food and Nutrition Security" (ISFNS) which emerged from a joint Thematic Evaluation of FAO and WFP "Information Systems for Food Security" (ISFS) conducted in 2009. The evaluation called on both agencies to strengthen their leadership in ISFS; promote ISFS that respond to specific needs of decision-makers; promote long-lasting, national multi-stakeholder partnerships; and develop and apply an ISFS communication and advocacy strategy. The evaluation also recommended that WFP and FAO develop a joint strategy with operational plans for complementary and shared ISFS support.

In 2010, FAO and WFP developed corporate strategies to guide their work on ISFNS. This was followed by the development of a Joint FAO-WFP Strategy for ISFNS which provides a clear statement on how both organizations will effectively support member states, and how they will work with international stakeholders concerned with achieving a sustainable reduction in poverty, hunger and malnutrition. Realizing the objectives of the Joint Strategy will be accomplished through strengthening – in the context of both development and emergency – the collection, management, analysis, dissemination, and use of data and information relevant to the design and implementation of policies and programmes to achieve food and nutrition security, while also addressing gender concerns and social inequalities.

This Joint Strategy is allied to WFP's and FAO's organizational work and takes advantage of the organizations' established leadership roles on the global food security stage at regional and country levels, while also explicitly covering nutrition security objectives. Its aim is to facilitate unified and coordinated action, supportive and complementary to the efforts of member states and development partners. The Joint Strategy builds on the following four "pillars" which represent key domains of FAO and WFP work that complement each other, while also responding to the distinct areas of demand expressed by major interest groups.

- Capacity development to support information systems on food and nutrition security of member countries
- Standards, methods, and tools for information systems on food and nutrition security
- Monitoring and in-country food security and nutrition assessments
- Statistics, information and analysis on food and nutrition security (global public goods)

Figure 1 articulates the linkages and synergies between the four components and how they support the overall vision as well as relationships with countries and other stakeholders. Successfully implemented, the ISFNS will provide a solid basis to improve the accuracy of existing food security gauges and to expand the range of food security measures towards a suite of indicators. It will also allow FAO and WFP to draw on their respective strengths in providing data and developing new concepts and methods.

FAO has a strong comparative advantage in setting standards for food security and nutrition indicators, measurements and analysis, and in management of information and data. FAO also provides a unique forum for discussion of ISFNS technical and policy issues. The strategy calls for these activities to continue with a more deliberate focus on: (i) research to advance better practice more quickly; (ii) identifying information needs on emerging issues affecting food security and nutrition; (iii) strengthening food access and consumption data; and (iv) improving measurement of gender and social inequities.

WFP's strengths are present in their current role in providing standardized methods and tools for food security assessment and vulnerability analysis at the global, regional, and national levels, while frequently working in direct collaboration with FAO and other partners in this domain. WFP will develop and disseminate normative guidance for household-level food security and nutrition assessments and analyses, as well as analyses related to disaster risk reduction and management.

The pillar on capacity development for food security monitoring is currently upgraded through efforts underway in the nascent multi-stakeholder Food Security Information Network (FSIN).

Food Security Information Network (FSIN)

The FSIN aims to focus capacity and institution building efforts at national and regional levels for enhanced preparedness and food crisis prevention policies with "communities of practice," using common standards and methodologies at all levels. It is these country and regional networks which are the bottom-up building blocks for a global food security information platform, that is able to inform reliably and objectively national as well as international decision-makers. FSIN envisages establishing a technical working group and a global data support group. The main challenge is in improving the quality of country level data and related analyses, and the links of the information suppliers with the most relevant decision makers. FSIN in itself is not a new system, but a process to build capacities and strengthen standards.

The EC-FAO Project (GCP/INT130/EU) Component for improving Hunger Related Statistics and Global Monitoring of MDG 1.9

The key yardstick for monitoring progress towards MDG 1.9 is the FAO indicator of the prevalence of undernourishment (PU). In the process of monitoring this MDG, two basic problems have surfaced. Firstly, the compilation of the PU indicator rests entirely with FAO, including the maintenance of the underlying parameter and database for compiling the PU indicator; and as a consequence, there is no country (or only limited country) ownership of results and methodology. Secondly, the FAO PU indicator is essentially the only gauge used to monitor progress towards MDG 1.9. The EC-FAO project aims to overcome these problems: (i) by supporting capacity development at the country level; and (ii) by promoting the development of a suite of indicators, including the provision of methodologies and guidance material that will allow practitioners to develop their own suite. When successfully implemented, countries will be able to: (i) capture the numerous dimensions of malnutrition; and (ii) regularly monitor various aspects of food security at the national and sub-national level.

FAO-World Bank collaboration on collecting, validating, and processing household survey based food security indicators

In order to ensure a successful implementation of the EC-FAO project component, the FAO Statistics Division has initiated a collaborative effort with the World Bank to enhance and expand its food security monitoring and measurement efforts in two areas: (i) developing guidelines on the collection of food consumption data at the household level and (ii) developing an evaluation and analysis tool for household survey based food information.

The first initiative involves two main activities:

- assessment of currently available micro datasets. The objective is to compile guidelines on how to increase the quality of food consumption data through improved survey design

- conduct research in enhancing the ability to capture food consumption data. This activity will be undertaken by a working group of experts, tasked with addressing the major shortcomings of current theory and practice in consumer survey design and implementation. In particular, the ability to properly capture food consumption (known problems include the collection of food consumed away from home, the distinction between acquisition and consumption, etc.)

The second initiative amounts to implementing a food security module to the Adept tool developed by the World Bank, with the aim to derive indicators on food security at national and sub-national levels.

CountrySTAT

One of the established capacity development programmes for food and food security information is FAO's CountrySTAT initiative. CountrySTAT (www.countrySTAT.org) is a web-based information technology system for food and agriculture statistics at the national and sub national levels. With support of the Bill and Melinda Gates Foundation (BMGF), the CountrySTAT system has been operationalized in 17 Sub-Saharan African countries and is currently being expanded to other African countries and to those outside the region. Based on concepts, definitions and classifications developed by FAO and used in FAOSTAT, CountrySTAT equips countries with a common system that better organizes, harmonizes and standardizes their statistical data from multiple sources and integrates them on a universal platform. With the provision of harmonized and comparable basic data, CountrySTAT is an important contributor to a more accurate and more reliable food security assessments.

Agricultural Market Information System (AMIS)

The recent G20 Ministerial Declaration on an "Action Plan on Food Price Volatility and Agriculture" (Paris, June 2011), recognized "the importance of timely, accurate and transparent information in helping to address food price volatility, and agree(d) on the need to improve the quality, reliability, accuracy, timeliness and comparability of data on agricultural markets". In doing so, Ministers at the meeting established the Agricultural Market Information System (AMIS) initiative to be housed at FAO.

AMIS aims at building capacity in selected countries to improve their own market intelligence and short-term outlook capability, through collecting timely and quality data. The G20 Ministerial Declaration foresees capacity development centred on the (i) production of a manual defining best practices and methodologies for agricultural market data collection and analysis; (ii) hosting a series of regional training sessions to enhance data collection capacity and to assist in the development of methodologies for food market outlook; and (iii) design and implementation of special projects, aiming at enhancing data collection.

Successfully implemented, AMIS will contribute to improved food security assessments by providing (i) greater predictability and transparency in global markets (ii) greater predictability and coherence in policy choices, (iii) Better forecasts for global export availabilities and import demands would lead to improved forecasting of trends in

international prices, and (iv) better global market assessments for traded food-security crops.

The Global Strategy

The main challenge for any initiative is to ensure the availability of relevant, reliable and timely basic data from country sources. Recent surveys have shown that the large majority of developing countries do not have a sustainable agricultural statistics system capable of producing even a minimum set of basic data that meets requirements for an acceptable information system on food security. The Global Strategy to Improve Agricultural and Rural Statistics was developed under the auspices of the United Nations Statistical Commission (UNSC) with the purpose of addressing the declining trend in food and agricultural data availability and quality mostly in developing countries. In February 2010, the 41st session of UNSC endorsed the Global Strategy. The Strategy is based on three pillars:

- The first pillar is the establishment of a minimum set of core data that countries will provide to meet current and emerging demands.

- The second pillar is the integration of agriculture into national statistical systems in order to satisfy the needs of policy-makers with data comparable across countries and over time. The integration will be achieved by implementing a set of methodologies that includes the development of a Master Sample Frame for Agriculture, the implementation of an Integrated Survey Framework, and the results available in a Data Management System.

- The third pillar is a foundation that will provide sustainability for agricultural statistics systems through governance and statistical capacity building.

Towards a coherent and comprehensive system of capacity building for food security

In conclusion, the above initiatives are intended to create a coherent and comprehensive information and capacity development system for food security monitoring. . They will help broaden the set of indicators to measure the various forms of food insecurity and help improve the accuracy of the various indicators.

Countries are key partners for the implementation of these initiatives and equally important, the development of a comprehensive and reliable food security information system for national and global stakeholders. Working in synergy, these initiatives are expected to pave the way for the improved monitoring of global food security.

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Figure 1: Linkages and synergies between the four components of the Joint FAO-WFP strategy on the Information System of Food and Nutrition Security