WFP - World Food Programme

NeKSAP Household Food Security and Child Nutrition Monitoring Survey:

2012 Questionnaire Re-design, Survey Re-design, Estimation, and Calibration with 2010 NLSS-III

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SUMMARY

1. WFP Nepal has been monitoring food security since 2002. WFP field surveillance capacity consists of a database management system (e-WIN) and integrated electronic data collection via field surveillance staff. The system allows rural, field-based household food security monitoring and analysis in near real-time. The annual sample is approximately 4,000 households, all of which are essentially rural. Data collected includes food security, market situation, water and sanitation, migration patterns, and child nutrition. The household survey is one of the core components of the Nepal Food Security Monitoring System (Nepal Khadhya Surakshya Anugaman Pranali: NeKSAP). The system is currently being institutionalized into the Nepal government system.

2. The data collected has also been used for non-food security purposes such as nutrition (Helen Keller International - HKI, Ministry of Health and Population), education (RIDA, UNICEF, Ministry of Education), and child protection (UNICEF).

3. NeKSAP household survey sampling design has evolved over the years in line with changing information requirements. In 2010, probability sampling was introduced to achieve better representation of seasonality and geographical area, subject to the continuing limitation of the survey to what are essentially rural areas.

4. The 2011 NeKSAP household survey also used probability sampling, although no estimates of accuracy that incorporated the complex survey design (which includes stratification, clustering and unequal selection probabilities) were calculated.

5. The further revision of the sample design in 2011 for 2012 and beyond involves:
   (a) modularising, amending and supplementing the questions in the questionnaire
   (b) redesigning the sample to improve estimates of quarterly and annual change, and to provide measures of accuracy (i.e. standard errors).

6. Field resource constraints meant that the revised NeKSAP survey design needed to have a similar sample size (of around 4000 households) to the 2010 and 2011 surveys.

7. Increased accuracy was achieved instead by use of rotation sampling, which divided the sample into four nationally-based subgroups in each quarter, resampling after initial selection in the following quarter, the following year and the following year plus one quarter. In each quarter, one new rotation group is introduced and one dropped, so that the four rotation groups sampled in each quarter have been in the sample 1, 2, 3 and 4 times respectively.

8.. Rotation sampling, which was first proposed in the 1940s and has been in use internationally since the 1960's, gains its extra accuracy for estimating quarterly and annual change from the positive correlation over time for the households within each rotation group. In this context, it is more accurate and involves slightly less fieldwork than choosing a completely new sample each quarter, and avoids the long term response fatigue associated with cross-sectional / panel surveys.

9.. Because the data collected through NeKSAP has been utilised by different thematic stakeholders for non- food security purposes such as nutrition (HKI, Ministry of Health and Population), education (RIDA, UNICEF, Ministry of Education), and child protection (UNICEF), redeveloping the questionnaire involved extensive consultation. In addition to a sequence of formal meetings, the NeKSAP Household Food Security and Child Nutrition Monitoring Re-Design Sharing Workshop was held in Kathmandu on 19 January 2012. The meetings and workshop provided a review of the VAM household (i.e. NeKSAP)

questionnaire, including the child nutrition module and, in conjunction with this review, discussed preparation of an analysis plan for seasonal reporting and annual reporting.

10. The analysis plan for the redesigned survey first involves calculating the estimates and their accuracy for each variable of interest for each rotation group in each quarter. This summary information for current and past data, then using both in conjunction to estimate the current level for each such variable, the change over time via the difference between the current estimate and that for the previous quarter (quarter to quarter change) and the change between the current estimate and that for the same quarter in the previous year (annual change). The correlation for a given variable between quarters and years is also estimated and used, since it is these correlations that provide the linkage that leads to more accurate estimates than are possible by using non-rotation types of sampling.

11. The NeKSAP household survey redesign for 2012 to 2016 also compared findings of 2010 NeKSAP household survey with those of the 2010 Nepal Living Standards Survey (NLSS-III) for the rural parts of Nepal. Generally, strong connections were found, but differences in question content, structure and format limit the extent to which NLSS-III can be a baseline for the ongoing quarterly NeKSAP survey, especially for such derived variables as food consumption score, coping strategy index, total expenditure on food, total land owned, wealth index, and sources of income. The NeKSAP household survey questionnaire has been revised to gain a greater comparability with NLSS-III for some variables such as coping, household asset and absentees.

12. Food consumption score (FCS) derived using aggregated data from NLSS-III is about 20% higher than FCS measured more directly from the NeKSAP survey. There are also regional variations. As for other indicators, this difference is not because either survey is in error, but because they ask different questions, use different categorizations, or have different scope. In the case of FCS a technical adjustment to provide an estimate of "equivalent FCS" from the two surveys is feasible. For other indicators direct comparison is more difficult, if not impossible. Further research to provide the most accurate comparisons of indicators possible, based on 2010 when both surveys were carried out, is ongoing.

1. BACKGROUND

WFP Nepal has been implementing the food security monitoring since 2002. The WFP field surveillance capacity is composed of an advanced database management system (e-WIN) and field surveillance staff (32 field monitors) equipped with Personal Digital Assistance (PDA) and satellite phone with modem connection, which enables provision to decision makers of field-based monitoring information and analysis in near real-time. On an annual basis, the system until end-2010 collected some 4,000 household observations and the data include a variety of thematic areas such as food security, market situation, water and sanitation, and migration patterns.

Since 2010 the child nutrition module has been introduced in collaboration with Helen Keller International (HKI) which collects data on Infant and Young Child Feeding (IYCF) indicators.

The data collected through the system has been utilised by different thematic stakeholders for purposes other than food security, such as nutrition (HKI, Ministry of Health and Population), education (RIDA, UNICEF, Ministry of Education) and child protection (UNICEF). It is worth noting that food security monitoring and analysis system (NeKSAP) is currently being institutionalised into the government system.

Household monitoring sampling design has evolved over the years in line with changing information requirements. Since 2010, probability sampling has been introduced to achieve better representation of seasonality and geographical area, subject to the continuing limitation of the survey to what are essentially rural areas.

The further revision of the sample design for 2011 involves two main parts:

1. modularising, as well as amending and supplementing the questions in the questionnaire.
2. redesigning the sample to improve estimates of quarterly and annual change, and to provide measures of accuracy (i.e. standard errors) for survey estimates based on or derived from the questions asked.

The 2011 redesign is also intended to improve alignment with the 2010 Nepal Living Standards Survey (NLSS-III), with an aim of comparing findings from NeKSAP and NLSS-III for the rural parts of Nepal, and where possible to track changes over time using NLSS-III as a baseline.

The revised design was implemented starting in the first quarter of 2012. The Terms of Reference included the following requirements.

Scope and Method

- Identify key household food security and child nutrition indicators for monitoring purposes based on the findings of the NLSS-III (also DHS and MICS as appropriate);

- Design sampling to track changes for the indicators on an annual and seasonal basis. Consider different sampling options including cross-section, panel and the combination of both;
- Review the NeKSAP household questionnaire (including the child nutrition module) and prepare an analysis plan for the seasonal reporting and the annual reporting. During the review process, calibrate the NeKSAP household data (2010& 2011) i.e., NeKSAP and the NLSS-III data to ensure comparability;
- Hold consultations with key stakeholders including the Central Bureau of Statistics and the World Bank;
- Document the sampling design, the analysis plan and the calibration results.

Deliverables

- Household food security and child nutrition monitoring sampling design and analysis plan.
- Revised questionnaire (s).
- Narrative report on the sampling design, analysis plan and the calibration results.
- The report should contain a brief summary for a non-technical audience.

2. SAMPLE RE-DESIGN

The intent is to retain as many of the features of the 2010 design as possible, both for ease of implementation on a tight time line, and because the number of field monitors and their location place limitations on feasible designs for the NeKSAP survey. The re-design also needs to be flexible so it can be expanded in terms of sample size should additional field resources become available. Of course additional field resources would also required if the questionnaire were lengthened, even if the sample size were not increased.

The statistics of interest from NeKSAP include measures of both level (i.e. the current value) and change (e.g. differences between successive quarters or years) for a range of food security and other variables, and measures derived from them. The optimal sample design for measuring both level and change is a rotation design. Rotation designs retain some, but not all, of the sample in subsequent periods, and allow sampled units to be sampled for a number of periods, taken out of the sample, then reintroduced back into the sample again for a limited number of quarters. This improves estimates of change markedly without unduly affecting measures of level.

The 2011 design and the 2012 re-design for NeKSAP consists of 12 strata, as detailed in Table 1:

Table 1: Sample frame: 2011 Nepal Census of Housing and Population

STRATUM	Stratum number	Total wards	Total households
Mountain East, Central and West	1	2671	222950
Mountain Far-West	2	1035	85463
Mountain Mid-West	3	1206	70685
Rural Hills Central	4	4167	623773
Rural Hills East	5	3554	330001
Rural Hills Far-West	6	1863	152698
Rural Hills Mid-West	7	2925	323449
Rural Hills West	8	5553	561469
Rural Terai Central	9	5289	753383
Rural Terai East	10	3429	671594
Rural Terai Mid-West and Far-West	11	1583	420836
Rural Terai West	12	1974	341027

For the 2012 re-design, wards within strata have been selected with probability proportional to size (i.e. to the number of households they contain, based on the provisional results of the 2011 Nepal Census of Housing and Population). Equal numbers of households have then been selected in each sampled ward.

Four rotation groups are sampled in each quarter. Each rotation group contains two wards or primary sampling units per stratum, making a total sample size of 12 * 4 * 2 = 96 psus per quarter. With 10 households sampled with equal probability within wards, this gives a sample of 96*10=960 households a quarter, and 3840 households per year.

- For each variable of interest (e.g. Food Consumption Score – FCS) the estimate from each rotation group in each quarter is calculated separately, along with its estimate of accuracy (i.e. standard error) in a way that allows for the stratification and clustering.
- The four estimates are independent of one another, but are each is positively correlated with the estimate from that rotation group, if it has been sampled in previous quarters.
- It is this correlation that improves estimates of change, since the rotation pattern retains each rotation group for two successive quarters, drops it, then re-introduces it for exactly the same quarters in the following year.

The rotation groups over a five year period, and the quarters for which each is and is not included in the sample are given in Table 2 below:

Table 2: Rotation groups for repeated NeKSAP quarterly survey

	2012				2013				2014				2015				2016			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	x															x	x			x
2	x	x															x	x		
3		x	x															x	x	
4			x	x															x	x
5	x			x	x															x
6	x	x			x	x														
7		x	x			x	x													
8			x	x			x	x												
9				x	x			x	x											
10					x	x			x	x										
11						x	x			x	x									
12							x	x			x	x								
13								x	x			x	x							
14									x	x			x	x						
15										x	x			x	x					
16											x	x			x	x				
17												x	x			x	x			
18													x	x			x	x		
19														x	x			x	x	
20															x	x			x	x

Notes:

1. There are four rotation groups in the sample in every quarter.

2. Each rotation groups contains the **same** primary sampling units (psu) / clusters / wards and the **same** household in every quarter in which it is included.
3. The exception is at the end of the five year period, illustrated in the top right hand corner of Table 2, when the psus can be the same as during 2012 but the households are reselected within psu. (If a redesign of the survey is contemplated at end 2015, it would be better to redraw the sample and select new psus for all new rotation groups beginning December 2015.)
4. If sampling is continued beyond five years without the survey being redesigned, the rotation groups in 2017 can and should be the same as in 2012, except that (as in note 3 above) the psus are identical but the households are reselected, and three of the rotation groups in 2017 quarter 1 will be identical (both in terms of psus and households) to those sampled in the final quarter of 2016.
5. Each rotation group contains specified psus. Different rotation groups may contain some psus that are the same as psus in other rotation groups although this will be rare. Where this occurs, the households chosen in such psus should be different in the different rotation groups.

Every sampled household in every quarter must have its rotation group recorded in the database (together with other household information including stratum, cluster, and household ID), every time it is interviewed. The numbering of the rotation group for each sampled household is to be recorded as 1 through 20 above as designated in Table 2 above.

Sampling of psus for each rotation group has been carried out from the 2011 list of wards in Nepal as provided by the Central Bureau of Statistics. Each rotation group contains psus sampled from every stratum, and sampling within stratum is probability proportional to estimated size. Size for each ward (i.e. psu) was the aggregated number of households in the population from the 2011 Nepal Census of Population and Housing.

The selection of psus in the first rotation group was determined as follows:

1. The list of wards was sorted by stratum.
2. Within each stratum, the wards were sorted by ID number, and (so that a probability proportional to estimated sample could be drawn) each was assigned a range of numbers in sequence (i.e. cumulatively within stratum) determined by the number of households each ward was projected to contain.
3. Within each stratum, a uniform random number between 1 and the total projected number of households in that stratum divided by 40 (since there are 20 rotation groups and two clusters (i.e. wards or psus) sampled per rotation group per stratum) was chosen as a starting point for sample selection of wards.
4. To determine the stratum sampling interval, the total stratum size (in terms of projected number of households) was divided by two since this is the number of wards required in the sample in that stratum for that quarter, when further divided

by twenty (since there are twenty rotation groups sampled in total, four in every quarter).

5. For each stratum, each psu determined by the initial random number plus twenty times the sampling interval was included in the sample for the first rotation group. This procedure ensures that the sample size for the rotation group in each stratum equals the required sample size for that rotation group. Note that, because 96 psus (i.e. wards) in total are sampled each quarter, the number of psus sampled in total across all strata for the first (and indeed every) rotation group is 24 (which by design is an integral multiple of the number of strata which is twelve).

The remaining rotation groups were effectively selected in exactly the same way, but using a different starting point, with these additional starting points chosen at equal intervals (i.e. systematically) rather than randomly. There are twenty rotation groups overall, and two psus sampled per stratum per rotation group, so the starting point for the kth of twenty rotation groups in each stratum was the random starting point for the first rotation group in each stratum, plus (k-1) times the stratum size (in terms of projected number of households) divided by 40 (since there are twenty rotation groups times two psus sampled per rotation group). In practice, the additional rotation groups have been implicitly selected by the process outlined in 1-5 above, as the sampling interval chosen there for the first rotation group determines the starting point for each of the other nineteen rotation groups within each stratum.

To ensure that rotation groups that are to be included in the sample are not too "close together" in the sequence, Table 3 was used:

Table 3: Link between sequence number and rotation group for NeKSAP survey

Sequence number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Rotation group	*1*	*13*	*3*	*9*	*17*	*5*	*11*	*4*	*15*	*19*	*2*	*14*	*7*	*10*	*18*	*6*	*12*	*8*	*16*	*20*

Note that the selection of psus / wards within strata for each rotation group is independent rather than mutually exclusive for the different rotation groups (to the extent that the series of twenty systematic samples of wards is random) so that, because wards are not equal in size, it is possible in principle for a particular ward (generally a larger one) to be included in more than one of the initial 20 rotation groups. Were this to occur, the selection of households within the duplicated ward should be different for the two rotation groups concerned, but, as before, the same households should be sampled within each rotation group each time it is included in the sample. This event is unlikely to occur however because each stratum contain such a large number of wards from which only forty are sampled.

Each rotation group of the twenty rotation groups in total for a five year period needs two clusters / wards / psus sampled per stratum, making 40 psus to be sampled per stratum for all 20 rotation groups combined. Note that the design for each rotation group is consequently a two psu per stratum design, and at each time point, since there are four rotation groups being used, there are 12x2x4=96 psus sampled in total. With 10 units / households selected per sampled cluster, this gives a total sample of 960 households per quarter and 960x4=3840 households per year - note however that because the rotation pattern resamples the same households, this does not correspond to 3840 different households per year, but to 24x9x10=2160 different households, since there are nine different rotation groups used each year. Note that the effective sample size is increased relative to a new sample of 960 household every quarter, through the efficiency gains derived from the correlation of some rotation groups with data collected in earlier quarters. See Section 3 for further details.

3. ESTIMATION

- For each variable of interest (e.g. Food Consumption Score – FCS) the estimate from each rotation group in each quarter is calculated separately, along with its estimate of accuracy (i.e. standard error) in a way that allows for the stratification, clustering and the selection probability for each household.
- The four estimates are independent of one another, but each is positively correlated with the estimate from that same rotation group, if it has been sampled in previous quarters.
- It is this correlation that improves estimates of change, since the rotation pattern retains each rotation group for two successive quarters, drops it, then re-introduces it for exactly the same quarters in the following year.
- Combining the estimates uses a linear model, i.e. least squares, in a way that accounts for the correlation between the results from the same rotation group in different quarters.
- Estimates of level and change between quarters or years all come from the fitting of this model. The model provides one overall estimate of level or change by combining the estimates from all sampled rotation groups up to the current time.

Summary of design and estimation

- The re-design for NeKSAP 2012 is strongly based on the sampling design used in 2011 - it uses the same strata, and both are two stage stratified cluster samples.
- Sample sizes for NeKSAP 2011 & 2012 are very similar, since increasing sample size risks over-loading the field monitors who carry out the interviews.
- The revised design is better able to estimate change between quarters and years, at the cost of some additional computation.
- Estimates of accuracy (in terms of standard errors) are possible using the 2012 re-design (and could be found retrospectively for NeKSAP 2010 & 2011).

Estimation – details.

The benefit of rotation sampling in comparison with selecting a separate sample at each time point is that it can be much more efficient, greatly decreasing the field work required to get estimates of change of a given accuracy.

It also has major benefits in comparison with a fixed panel study, as respondent fatigue and loss of respondents over time can be major problems with panel or cross-sectional samples.

The estimates outlined below from rotation sampling are unbiased, when variances from rotation groups at each time period are all equal and the correlations over time are stable. If they are not, then the appropriate values can be inserted where necessary instead of average ones, and the estimation is again unbiased.

The simplest and earliest example of a rotation sampling scheme is that given by Jessen (1942), in which there are two time periods with equal sample sizes in each, and the sample selected in the first period contains some but not all of units selected in the first period.

Using the same schemata as before the rotation scheme for this design is simply as given in Table 4:

Table 4: Rotation Groups for simple repeated survey

	1	2
1	x	
2	x	x
3		x

Note: Rows denote rotation groups, 1, 2 & 3; columns denote times 1 &2.

where the rotation group 1 is the unmatched units at time 1, rotation group 2 is the unmatched units at times 1 and 2, and rotation group 3 is the unmatched units at time 2.

Consider a single variable collected in the survey (or derived from it) at both times one and two, and let us find the best estimate the means β_1 and β_2 at times one or two, and of the difference between the two time periods, β_1 - β_2.

Let $\bar{Y}_{u1}$ = mean of unmatched units in period 1, with sampling error e_{u1}

$\bar{Y}_{m1}$ = mean of matched units in period 1, with sampling error e_{m1}

$\bar{Y}_{u2}$ = mean of unmatched units in period 2, with sampling error e_{u2}

$\bar{Y}_{m2}$ = mean of matched units in period 2, with sampling error e_{u2}

ρ = correlation between matched units at times 1 and 2

β_1= parameter of interest at time 1

β_2= parameter of interest at time 2

u= number of unmatched units at times 1 and 2

m = number of matched units at times 1 and 2

n. = sample size at each of times 1 and 2, so that n=u+m

S^2 = the common population variance.

Note that the sample does not need to be a simple random sample, but if it is not then means must be computed as weighted means based on inverse of selection probability, so must correlations, and u and m must be replaced by their effective sample sizes u* and m* from the complex design used (or equivalently the estimated variances of $\bar{Y}_{1u}$, $\bar{Y}_{1m}$, $\bar{Y}_{2u}$ and $\bar{Y}_{2m}$ must be replaced by the estimates from the sample data based on the complex design).

Then in matrix notation

$$\begin{pmatrix} \overline{Y}_{u1} \\ \overline{Y}_{m1} \\ \overline{Y}_{u2} \\ \overline{Y}_{m2} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 1 & 0 \\ 0 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} e_{u1} \\ e_{m1} \\ e_{u2} \\ e_{m2} \end{pmatrix}$$

or more compactly

$$\boldsymbol{Y} = \boldsymbol{X}\boldsymbol{\beta} + \boldsymbol{e} \tag{1}$$

Now the variance of $\boldsymbol{Y}$ is given by

$$var(\boldsymbol{Y}) = \boldsymbol{\Sigma} = S^2 \begin{pmatrix} 1/u & 0 & 0 & 0 \\ 0 & 1/m & 0 & \rho/m \\ 0 & 0 & 1/u & 0 \\ 0 & \rho/m & 0 & 1/m \end{pmatrix}$$

This finding the inverse of $\boldsymbol{\Sigma}$ yields

$$\boldsymbol{\Sigma}^{-1} = \frac{1}{S^2} \begin{pmatrix} u & 0 & 0 & 0 \\ 0 & \frac{m}{1-\rho^2} & 0 & -\frac{m\rho}{1-\rho^2} \\ 0 & 0 & u & 0 \\ 0 & -\frac{m\rho}{1-\rho^2} & 0 & \frac{m}{1-\rho^2} \end{pmatrix}$$

The best linear unbiased estimate (BLUE) of $\boldsymbol{\beta}$ is

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{X})^{-1}\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{Y} \tag{2}$$

with

$$var(\hat{\boldsymbol{\beta}}) = (\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{X})^{-1} \tag{3}$$

which in non-matrix notation gives

$$\hat{\beta}_2 = (n^2 - u^2\rho^2)^{-1}\left[mu\rho\overline{Y}_{u1} - mu\rho\overline{Y}_{m1} + u(n - u\rho^2)\overline{Y}_{u2} + nm\overline{Y}_{u2}\right]$$

and

$$var(\hat{\beta}_2) = S^2(n-u\rho^2)/(n^2-u^2\rho^2)$$

The situation for the NeKSAP rotation scheme is a little more complicated, but the same principles still apply - as do the numbered equations (1) to (3) once the relevant matrices have been suitably redefined.

For 2012 Q1, no psu has been previously sampled so that all estimates for this quarter are just the usual sample survey estimates, ignoring the rotation pattern.

Table 5: Linking year and quarter with times, *t*, for repeated NeKSAP survey

Y	2012				2013				2014				2015				2016			
Q	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
t	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

For the quarters that follow, we need to consider the rotation groups separately. Let $\bar{Y}_{it}$ be the mean for the *i*th rotation group in quarter *t*. The year and quarter within year are then given by *int*[2012+(*t*-1)/4] and 4**rem*[(*t*-1)/4]+1 where *int* denotes integer part, and *rem* denotes remainder.

For 2012 Q2, we need to consider the data collected in both this and the previous quarter.
Using the new more general notation relates to that used previously via $\bar{Y}_{u1} = \bar{Y}_{11}$, $\bar{Y}_{m1} = \bar{Y}_{21}$, $\bar{Y}_{u2} = \bar{Y}_{32}$ and $\bar{Y}_{m2} = \bar{Y}_{22}$. However for 2012 Q2 we have not one but two independent versions of Jessen's scheme combined, with the addition of a complex design, so that our estimator and its variance are given by:

$$\hat{\beta}_2 = (n^2-u^2\rho^2)^{-1}\left[mu\rho(\bar{Y}_{11}+\bar{Y}_{51}) - mu\rho(\bar{Y}_{21}+\bar{Y}_{61}) + u(n-u\rho^2)(\bar{Y}_{32}+\bar{Y}_{71}) + nm(\bar{Y}_{22}+\bar{Y}_{62})\right]$$

and

$$var(\hat{\beta}_2) = S^2 d(n-u\rho^2)/(n^2-u^2\rho^2)$$

where $u = n_{11}+n_{51} = n_{32}+n_{72}$; $m = n_{21}+n_{61} = n_{22}+n_{62}$; $m = u$; $n_{11} = n_{51} = n_{32} = n_{72}$; $n = m+u$ as before; and *d* is the design effect for the mean of the variables concerned available through the output of SPSS or Stata when survey related procedures are used. (Note that *d* does not appear in the equation for $\hat{\beta}_2$ because it cancels out entirely, since all terms involving *u*, *m* and *n* in both numerator and denominator in the survey-adjusted version are scaled by the same *d*.)

The sample sizes *u*, *m* and *n* are fixed, but both *d* and ρ must be estimated from the sample rotation groups, and will vary for different questionnaire variables.. Since they will also vary slightly for different rotation groups an average value of both across all relevant rotation groups should be used. The design effect *d* should be estimated from the average of rotation groups 2, 3, 6 and 7 at time (i.e. quarter) 2, and ρ should be estimated as the simple average of ρ from each of the weighted correlations for times 1 and 2 between the matched units in rotation groups 2 and 6.

If the best linear unbiased estimate of the change between quarter 1 and 2 is required, we need the best linear estimate of β_1 based on the data at both times 1 and 2, namely $\hat{\beta}_1^{1,2}$ and its variance $var(\hat{\beta}_1^{1,2})$. We also need the covariance between $\hat{\beta}_1^{1,2}$ and $\hat{\beta}_2$, namely $cov(\hat{\beta}_1^{1,2}, \hat{\beta}_2)$ (which could be written in a slightly different notation that better explains the connection as $cov(\hat{\beta}_1^{1,2}, \hat{\beta}_2^{1,2})$). Now

$$\hat{\beta}_1^{1,2} = (n^2 - u^2\rho^2)^{-1}\left[u(n-u\rho^2)(\overline{Y}_{11}+\overline{Y}_{51}) + nm(\overline{Y}_{21}+\overline{Y}_{61}) + mu\rho(\overline{Y}_{32}+\overline{Y}_{71}) - mu\rho(\overline{Y}_{22}+\overline{Y}_{62})\right]$$

$$var(\hat{\beta}_1^{1,2}) = S^2 d(n-u\rho^2)/(n^2-u^2\rho^2)$$

and

$$cov(\hat{\beta}_1^{1,2}, \hat{\beta}_2) = S^2 dm\rho/(n^2-u^2\rho^2)$$

Then the best estimate of the change between time periods 1 and 2 is the difference between β_1 and β_2 is $(\hat{\beta}_1^{1,2} - \hat{\beta}_2)$ which has variance

$$var(\hat{\beta}_1^{1,2} - \hat{\beta}_2) = [\, var(\hat{\beta}_1^{1,2}) + 2\, cov(\hat{\beta}_1^{1,2}, \hat{\beta}_2) + var(\hat{\beta}_2)\,].$$

For 2012 Q3 and beyond, the required estimators and their variance are better dealt with directly using matrix algebra and equations (1) to (3). All that is required is to stipulate the relevant matrices and use these equations to find the estimates. Some additional comments before doing this may be useful however.

As the number of time periods increases there are multiple options for estimating *d* and the relevant correlations which after enough quarters of data extend to $\rho_{t,t-1}$ the quarter to quarter correlation, $\rho_{t,t-4}$ the year to year correlation and $\rho_{t,t-5}$ the year to year plus one quarter correlation. For estimating *d*, since the inherent design does not change over time, it is sufficient for each variable of interest to average the design effects of each rotation group either for the relevant time period or over all the period of the data. In practice checking for stability of *d* over time should help to decide this question. If *d* is changing over time, then using the most recent period or an average that relies more heavily on the most recent periods is recommended. For the correlations, a similar strategy is wise, i.e. for each rotation group that has been in the sample for two consecutive periods estimate $\rho_{t,t-1}$ and look at whether the average for each *t* is changing over time. If not an overall average of all the available estimates of $\rho_{t,t-1}$ will suffice; otherwise after checking that estimates for each given fixed value of t are similar, the estimate of $\rho_{t,t-1}$ should be weighted toward more recent quarters, t. The same basic rules apply for estimating $\rho_{t,t-4}$ and $\rho_{t,t-5}$ where they are required.

Given these preliminaries, it is simplest to consider the structure of the relevant matrices for the general case after there are six quarters of data, then work backward to consider the cases where there are five, four, three and two periods of data. The formulae for two periods of data derived in this way correspond with and are identical to the formulae given above for 2012 Q2.

Table 6: Conceptual rotation groups for repeated NeKSAP quarterly survey

	…	…	***t*-5**	***t* -4**	***t* -3**	***t* -2**	***t* -1**	***t***	…	…
…	x	x								
r		x	x							
***r*+1**			x	x						
***r*+2**	x			x	x					
***r*+3**	x	x			x	x				
***r*+4**		x	x			x	x			
***r*+5**			x	x			x	x		
***r*+6**				x	x			x	x	
***r*+7**					x	x			x	x
***r*+8**						x	x			x
***r*+9**							x	x		
***r*+10**								x	x	
…									x	x

After six quarters or more, at time t when estimating $\hat{\beta}_t^{(t-5,\ldots,t)}$ (the level at time t based on the data for the six periods: $t-5, t-4, t-3,\ t-2,\ t-1, t$ there are eleven rotation groups involved. This can be seen explicitly by looking along the each of the rows of the general rotation table, given in Table 6 above. The first rotation group r has appeared at time $t-5$ only, the second rotation group r+1 has been sampled at times $t-5$ and $t-4$, etc., so that rotation groups r to r+10 have been sampled 1, 2, 2, 2, 3, 4, 3, 2, 2, 2, 1 times respectively over this six quarter period. Since there are four rotation groups sampled per quarter and six quarters there are 24 in all, which coincides with the sum of 1, 2, 2, 2, 3, 4, 3, 2, 2, 2, and 1. When there are more than six quarters since beginning sampling in 2012Q1, the sequence involved could be extended but, since the interest is in level and in quarter to quarter and year to year change only, there is limited benefit in terms of efficiency and additional complexity in doing so.

There is no correlation between estimates from different rotation groups, even when data from two of them is collected at the same time. Since permutation has no effect on the result, as will be shown below it is simpler to reorder the data by rotation group rather than by time. This yields the following ordering of the estimates from each rotation group for the six periods:

$$\bar{Y}_{r,t-5};\bar{Y}_{r+1,t-5},\bar{Y}_{r+1,t-4};\bar{Y}_{r+2,t-4},\bar{Y}_{r+2,t-3};\bar{Y}_{r+3,t-3},\bar{Y}_{r+3,t-2};\bar{Y}_{r+4,t-5},\bar{Y}_{r+4,t-2},\bar{Y}_{r+4,t-1};$$
$$\bar{Y}_{r+5,t-5},\bar{Y}_{r+5,t-4},\bar{Y}_{r+5,t-1},\bar{Y}_{r+5,t};$$
$$\bar{Y}_{r+6,t-4},\bar{Y}_{r+6,t-3},\bar{Y}_{r+6,t};\bar{Y}_{r+7,t-3},\bar{Y}_{r+7,t-2};\bar{Y}_{r+8,t-2},\bar{Y}_{r+8,t-1};\bar{Y}_{r+9,t-1},\bar{Y}_{r+9,t};\bar{Y}_{r+10,t}$$

Treating this sequence as a single 1x24 row vector, and transposing, gives the required $\boldsymbol{Y}$ for equation (1).

Let

$$\boldsymbol{\beta}=\begin{pmatrix}\beta_{t-5}\\ \beta_{t-4}\\ \beta_{t-3}\\ \beta_{t-2}\\ \beta_{t-1}\\ \beta_{t}\\ \end{pmatrix}$$

The matrix $\boldsymbol{X}$ in equation (1) is then made up of eleven parts concatenated below one another, i.e.

$$\boldsymbol{X}=\begin{pmatrix}\boldsymbol{X}_{r}\\ \boldsymbol{X}_{r+1}\\ \boldsymbol{X}_{r+2}\\ \boldsymbol{X}_{r+3}\\ \boldsymbol{X}_{r+4}\\ \boldsymbol{X}_{r+5}\\ \boldsymbol{X}_{r+6}\\ \boldsymbol{X}_{r+7}\\ \boldsymbol{X}_{r+8}\\ \boldsymbol{X}_{r+9}\\ \boldsymbol{X}_{r+10}\end{pmatrix}$$

where, because a one in the t'th column indicates that $\beta_{t'}$ is being estimated:

$$\boldsymbol{X}_{r}=\begin{pmatrix}1 & 0 & 0 & 0 & 0 & 0\end{pmatrix}$$

$$X_{r+1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$X_{r+2} = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \end{pmatrix}$$

$$X_{r+3} = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$X_{r+4} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$X_{r+5} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$X_{r+6} = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$X_{r+7} = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

$$X_{r+8} = \begin{pmatrix} 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$X_{r+9} = \begin{pmatrix} 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$X_{r+10} = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

It remains only to specify the covariance matrix, $\boldsymbol{\Sigma}$, which has a block structure in which every submatrix designated as **0** is a matrix of zeros:

$$
\boldsymbol{\Sigma} = \begin{pmatrix}
\boldsymbol{\Sigma}_r & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \boldsymbol{\Sigma}_{r+1} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+2} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+3} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+4} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+5} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+6} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+7} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+8} & \mathbf{0} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+9} & \mathbf{0} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \boldsymbol{\Sigma}_{r+10}
\end{pmatrix}
$$

where, with $n_0 = n/4$ being the size of each rotation group and *d* the pooled design effect for a given variable

$$\boldsymbol{\Sigma}_r = 4S^2 / n_0$$

$$\boldsymbol{\Sigma}_{r+1} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+2} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+3} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+4} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-3} & \rho_{t,t-4} \\ \rho_{t,t-3} & 1 & \rho_{t,t-1} \\ \rho_{t,t-4} & \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+5} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-1} & \rho_{t,t-4} & \rho_{t,t-5} \\ \rho_{t,t-1} & 1 & \rho_{t,t-3} & \rho_{t,t-4} \\ \rho_{t,t-4} & \rho_{t,t-3} & 1 & \rho_{t,t-1} \\ \rho_{t,t-5} & \rho_{t,t-4} & \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+6} = (4S^2 / n_0)\begin{pmatrix} 1 & \rho_{t,t-1} & \rho_{t,t-4} \\ \rho_{t,t-1} & 1 & \rho_{t,t-3} \\ \rho_{t,t-4} & \rho_{t,t-3} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+7} = (4S^2 \,/\, n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+8} = (4S^2 \,/\, n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+9} = (4S^2 \,/\, n_0)\begin{pmatrix} 1 & \rho_{t,t-1} \\ \rho_{t,t-1} & 1 \end{pmatrix}$$

$$\boldsymbol{\Sigma}_{r+10} = 4S^2 \,/\, n_0$$

With these preliminaries, the best linear unbiased estimate (BLUE) of $\boldsymbol{\beta}$ is

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{X})^{-1}\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{Y} \qquad (2)$$

with

$$var(\hat{\boldsymbol{\beta}}) = (\boldsymbol{X}^{\mathrm{T}}\boldsymbol{\Sigma}^{-1}\boldsymbol{X})^{-1} \qquad (3)$$

as before.

Estimates of change

The best linear unbiased estimator of the quarter to quarter change from period t to period $t-1$ and its variance are given by $\boldsymbol{l}^{\mathrm{T}}\hat{\boldsymbol{\beta}}$ and $\boldsymbol{l}^{\mathrm{T}}var(\hat{\boldsymbol{\beta}})\boldsymbol{l}$ respectively, where $\boldsymbol{l}^{\mathrm{T}} = \begin{pmatrix}0 & 0 & 0 & 0 & -1 & 1\end{pmatrix}$

Replacing $\boldsymbol{l}^{\mathrm{T}}$ by $\boldsymbol{l}^{\mathrm{T}} = \begin{pmatrix}0 & -1 & 0 & 0 & 0 & 1\end{pmatrix}$ and re-computing gives the year to year change between quarters $t-4$ and t and its variance.

Annual estimates

Annual estimates of means that include the current period can be derived by using $\boldsymbol{l}^{\mathrm{T}} = \begin{pmatrix}0 & 0 & 1 & 1 & 1 & 1\end{pmatrix}$ / 4, as detailed above.

Fewer than six quarters of data

Let us know work backwards through five, four, three to two periods of data. It will be easiest to establish some general principles rather than providing a large amount of explicit detail, as the structure outlined above only needs amending by deleting rotation groups that will not be sampled when there are fewer than six quarters of data, and removal of the relevant parts of $\boldsymbol{Y}$, $\boldsymbol{X}$, $\boldsymbol{\beta}$, and $\boldsymbol{\Sigma}$. With this proviso, formulae (1) to (3) will still then apply, as will the formulae for estimates of change and their variances. Note however that for fewer than five quarters of data, the year to year change is of course not estimable.

When there are only five periods of data (as can be seen from the general rotation group pattern), since the relevant data at $t-5$ will not have been collected,

$$\bar{Y}_{r,t-5};\bar{Y}_{r+1,t-5};\bar{Y}_{r+4,t-5} \text{ and } \bar{Y}_{r+5,t-5}$$

must be removed from

$$\bar{Y}_{r,t-5};\bar{Y}_{r+1,t-5},\bar{Y}_{r+1,t-4};\bar{Y}_{r+2,t-4},\bar{Y}_{r+2,t-3};\bar{Y}_{r+3,t-3},\bar{Y}_{r+3,t-2};\bar{Y}_{r+4,t-5},\bar{Y}_{r+4,t-2},\bar{Y}_{r+4,t-1};$$
$$\bar{Y}_{r+5,t-5},\bar{Y}_{r+5,t-4},\bar{Y}_{r+5,t-1},\bar{Y}_{r+5,t};$$
$$\bar{Y}_{r+6,t-4},\bar{Y}_{r+6,t-3},\bar{Y}_{r+6,t};\bar{Y}_{r+7,t-3},\bar{Y}_{r+7,t-2};\bar{Y}_{r+8,t-2},\bar{Y}_{r+8,t-1};\bar{Y}_{r+9,t-1},\bar{Y}_{r+9,t};\bar{Y}_{r+10,t}$$

When there are four periods of data $\bar{Y}_{r+1,t-4};\bar{Y}_{r+2,t-4};\ \bar{Y}_{r+5,t-4};\bar{Y}_{r+6,t-4}$ must also be removed.

With three periods of data, an additional four rotation group estimates must also be removed namely, $\bar{Y}_{r+2,t-3};\bar{Y}_{r+3,t-3};\bar{Y}_{r+6,t-3};\bar{Y}_{r+7,t-3}$

For two quarters of data, only $\bar{Y}_{r+4,t-1};\bar{Y}_{r+5,t-1},\bar{Y}_{r+5,t};\bar{Y}_{r+6,t};\bar{Y}_{r+8,t-1};\bar{Y}_{r+9,t-1},\bar{Y}_{r+9,t};\bar{Y}_{r+10,t}$ remain.

The corresponding rows of $\boldsymbol{X}$ must be removed in each case, and for each quarter fewer one element of $\boldsymbol{\beta}$ is also dropped, beginning with β_{t-5}. Noting that $\boldsymbol{\Sigma}$ in its full form is a 24x24 matrix, removal of the row and column corresponding to the elements removed from $\boldsymbol{Y}$ redefines $\boldsymbol{\Sigma}$ as required, i.e. if the *k*th element of $\boldsymbol{Y}$ is dropped, then so are the *k*th row and column of $\boldsymbol{\Sigma}$.

For the modularisation of the revised questionnaire discussed in Section 4, where a module is run in some periods only, the removal process is similar. Since Y is not measured in periods when the module is not run, the elements of $\boldsymbol{Y}$, $\boldsymbol{X}$, $\boldsymbol{\beta}$ and $\boldsymbol{\Sigma}$ corresponding to the non-utilised rotation groups in each period should be deleted before estimates and their variances are calculated.

Estimation – links to field operation

The sample survey weighting required to get unbiased estimates of Y for each rotation group at each time requires some amendment if there are not 10 households in every cluster sampled. The solution is straightforward – those households that are in the cluster should all be sampled and the weight for them should be adjusted upward by a factor of ten divided by the number of households in the cluster. Estimation and estimation of standard errors can then proceed as usual, using specialized sample survey software.

When a household in a sampled cluster cannot be sampled and needs to be replaced, this must be done at random, not by choosing the nearest neighbour. Estimation for that time point can proceed as usual. When correlations over time are being estimated, providing the number of substituted households is small, the correlation can simply be estimated by leaving out the original and substituted household, but retaining the sample survey weights.

When a cluster cannot be sampled, a substitution list selected randomly has been provided. Again simply sampling the adjacent cluster is not recommended, unless by chance it has been chosen randomly from the list. Households in the new cluster will have associated weights and these are to be used for estimation and for standard error estimation. Again if estimating correlation over time, to a first approximation the original and substituted clusters should be dropped from the calculation.

4. QUESTIONNAIRE REDESIGN

The revised questionnaire is given in Appendix 5.

Because the data collected through NeKSAP has been utilised by different thematic stakeholders for non- food security purposes such as nutrition (HKI, Ministry of Health and Population), education (RIDA, UNICEF, Ministry of Education), and child protection (UNICEF), redeveloping the questionnaire involved extensive consultation. A list of the formal meetings held is given in Appendix 4, along with the list of people who attended those meetings. In addition, the NeKSAP Household Food Security and Child Nutrition Monitoring Re-Design Sharing Workshop was held in Kathmandu on 19 January 2012. See Appendix 1 for details; again, attendees are given in Appendix 4.

The intention was to review the VAM household (i.e. NeKSAP) questionnaire, including the child nutrition module and, in conjunction with this review, to prepare an analysis plan for seasonal reporting and annual reporting. The analysis plan for seasonal (i.e. quarterly and annual reporting) together with the methodology for estimating change has been given already in Section 3.

During the review process, a study was undertaken to assess the potential to calibrate the VAM household data 2010& 2011 (i.e. NeKSAP) and the NLSS-III data to ensure comparability. This is the topic of Section 5.

The child nutrition module was first introduced in 2010 in collaboration with Helen Keller International (HKI) which collects data on Infant and Young Child Feeding (IYCF) indicators, and changes made to this module were limited. Other parts of the questionnaire were modularized during the review (see Appendix 5 for details). The intention was to simplify administration of the questionnaire in the field as well as to clarify its contents. Questions within existing modules were also amended and supplemented.

There were two primary constraints when revising the questionnaire:

(a) The field monitors were limited to a total annual sample size of around 4000 households, based on sampling approximately 1000 per quarter and a questionnaire of the length of that used on 2010 and 2011. Markedly increasing questionnaire length was not an option.

(b) There are subpopulations on which information would be very useful, e.g. children under two years of age (rather than under five years), but to sample these sufficiently accurately to be useful would have involved a considerable increase in sample size. This is not feasible under current resource constraints.

Both these aspects have impacted on the types of supplements that could be added to the questionnaire.

The modularisation has an additional advantage - non-core modules need not be run in every quarter. For example, if annual change based on a particular season were required, including that module for that quarter of two consecutive years would suffice providing the estimates were of sufficient accuracy. This aspect has not been fully explored in this report from a sampling (as distinct from questionnaire) point of view, as both implementation and detail depend on further discussion by WFP with other interested agencies.

The final questionnaire detailed in Appendix 5 was finalised and approved by WFP.

5. CALIBRATION OF 2010 NLSS-III AND 2010 NEKSAP

The NeKSAP redesign for 2012 to 2016 also involved comparing findings of 2010 NeKSAP with those of the 2010 Nepal Living Standards Survey (NLSS-III) for the rural parts of Nepal. This calibration fed into the NeKSAP household questionnaire review process, providing the basis for determining which key food security variables are comparable and to what extent, and what modification in the NeKSAP questionnaire could best be recommended to ensure the two surveys can be compared.

Generally linkages were found, but differences in question content, structure and format have limited the extent to which NLSS-III can be a baseline for the ongoing quarterly NeKSAP survey, especially for such derived variables as food consumption score, coping strategy index, total expenditure on food, total land owned, wealth index, and sources of income. A detailed analysis of these variables follows based on the NeKSAP 2010 and NLSS-III 2010 data. The conceptual question of the underlying statistical properties of these estimators, while discussed briefly, is a topic beyond the scope of the current study.

Comparison of Food Consumption Score from NLSS-III and the NeKSAP

The Food Consumption Score (FCS) derived from NLSS-III and NeKSAP, while identical in concept, differs in implementation. NLSS-III counts of number of days out of seven for which individual items within the wider food groups considered by NeKSAP are consumed.

As a measure, FCS has some undesirable statistical properties. One of these is that it is not additive, i.e. adding the seven day counts for all items in a food group does not equal the food group value. An extreme example is that if there were four items in a group and they each had been eaten all seven days, the total would be 28 rather than the actual maximum of seven days out of seven for the food group as a whole. Even in less extreme cases, when two items in a group are consumed on the same day, the total of FCS over the items will not equal the actual group total.

Hence, if the NLSS-III measure is treated as additive, even with a cutoff set at seven, there will be a bias upward that the NeKSAP survey avoids. This does not mean there is an error with NLSS-III or with NeKSAP, only that NLSS-III measures FCS at a finer level. The NeKSAP FCS measure cannot be disaggregated to produce an equivalent to the NLSS-III FCS. The only option, which is not ideal, is to aggregate the NLSS-III score, recognising that the aggregate will over-estimate NeKSAP FCS even if the maximum is set at seven and all households with an FCS greater than seven are reset to seven.

The actual average values of FCS from NeKSAP and from NLSS-III when aggregated in this non-ideal way, do differ as expected. The national mean values are tabulated in Table 7 below. Note that as expected, the NLSS-III estimate is considerably and significantly higher than that from NeKSAP.

FCS derived using aggregated data from NLSS-III is about 20% higher than FCS measured more directly from the NeKSAP survey. The standard errors and confidence intervals above, which incorporate the complex design for both surveys indicate clearly that the difference is a real one.

Table 7: Comparison of NeKSAP FCS and aggregated NLSS-III FCS

NeKSAP Survey 2010 (WFP)	
Mean	49.76
SE mean	1.00
Lower 95% limit for mean	47.79
Upper 95% limit for mean	51.72
NLSS-III 2010 (CBS)	
Mean	60.46
SE mean	0.66
Lower 95% limit for mean	59.17
Upper 95% limit for mean	61.75

One potential solution is to consider quantiles for the FCS from both surveys and to calibrate FCS across the two surveys. This links the comparative levels of FCS from the FSM survey and that derived from NLSS-III using the unavoidably non-ideal methodology above, since they can then be compared at the quintiles (i.e. cumulative probabilities)

What follows is the detailed comparison of distribution function (i.e. cumulative probability) of food consumption score from NeKSAP 2010 and the NLSS-III 2010. For example, quintile boundaries are at 0, 20, 40, 60, 80 and 100 percent.

Twelve different analysis groups are used. These are not equal in size or in sample size, which is in part why some of the lines connecting the points on the graphs are rather more non-linear that others. The smaller analysis groups generally have more variation. Each line would ideally be a line of slope one and intercept zero. This would correspond to averages being equal and the distribution of food scores across households having the same pattern. The graphs have been produced allowing for the survey weights for households, so they reflect a population estimate of the distribution for both surveys.

It is clear from Table 7, as noted already, that the means of FCS for NeKSAP and NLSS-III are not equal. It is also clear from the graphs below that intercepts are not zero, and slopes are not equal to one. Indeed some of the graphs are distinctly non-linear. This indicates that the problem evident in Table 7 is deep-seated - it is not just a difference of level for the two surveys.

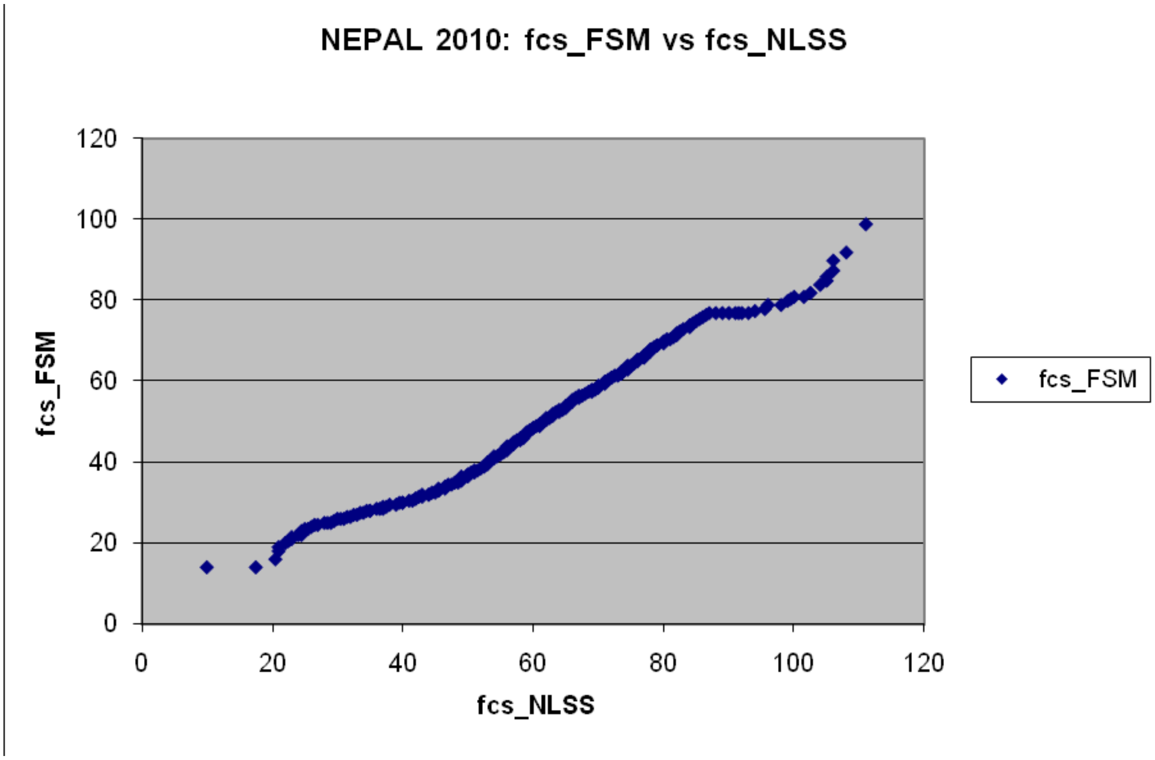
There remains the possibility of further analysis that would involve additional statistical modeling. For example, an underlying model for the empirical distribution functions with different intercepts and slopes for at least some of the analysis groups could be formally developed, with the deviations from the fitted line itself being fitted using an autoregressive structure as for time series (since positive deviations from the underlying line fitted to the empirical distribution function, represented by the percentiles, tend to be followed by positive deviations, and negative deviations by negative ones).. Initial tests have indicated that an autoregressive process of order two, usually denoted as an AR(2), would suffice, although such time series modelling is not ideal as it implies a particular ordering of the data as predictors of model errors in an AR(2) can only depend on earlier percentiles, A spline smoother for the deviations is therefore better, *a priori*, since it can smooth locally using observations on both sides of a given percentile in the empirical distribution function. A further alternative would be to consider the comparison as a Brownian Bridge. However it is evident from the graphs which follow that there is no simple straightforward solution, only a sequence of more complicated statistical approximations.

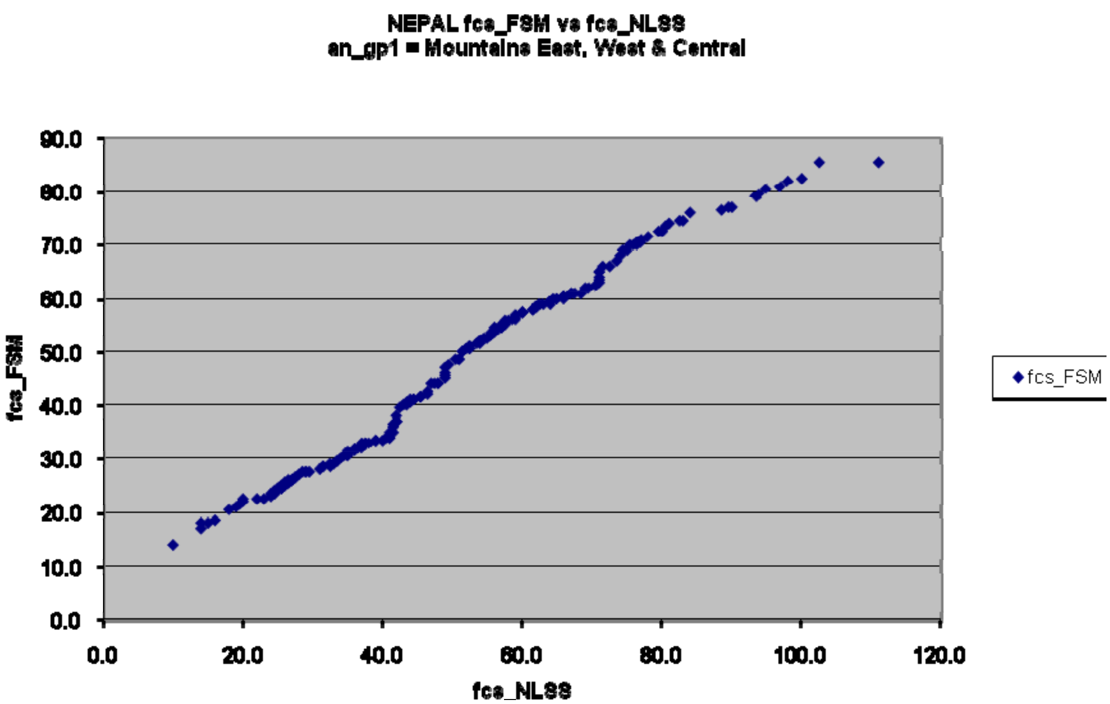
One possibility that may remain useful however, would be to take the level of FCS from NeKSAP viewed as the nutritional minimum and read from the graphs what the corresponding value is for NLSS-III, or vice versa. If this option is considered further research on the accuracy of this method is warranted, although this involves some theoretical statistics which falls outside they scope of the present study.

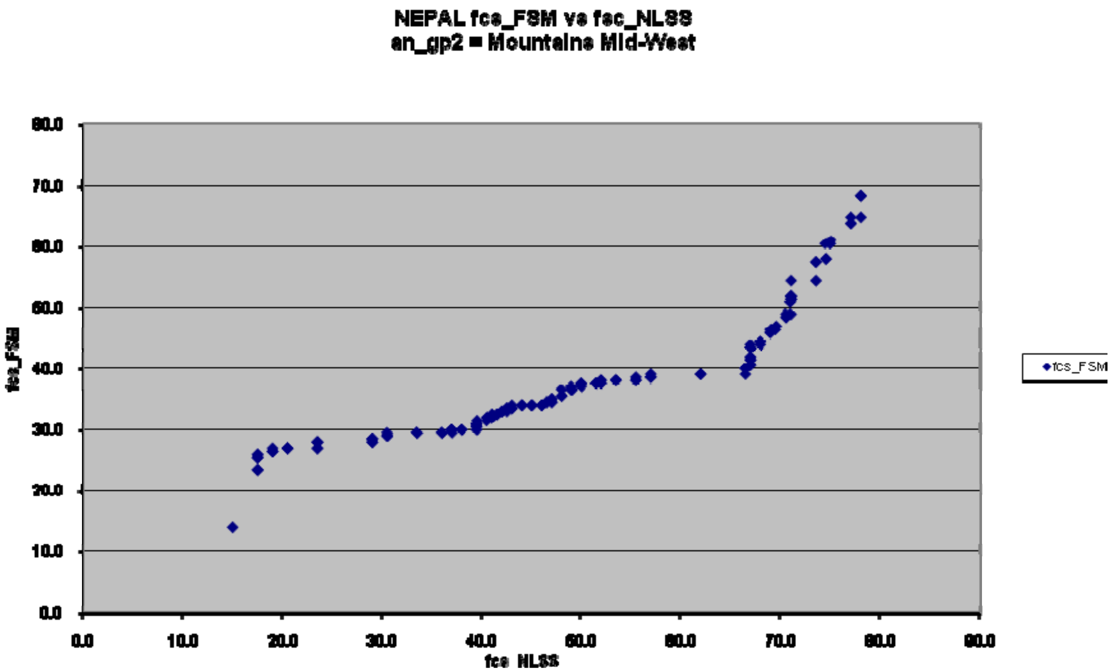
The graphs given below are first for the national FCS estimates, then for each sub-population determined by the analysis groups in Table 8 in turn.

Table 8: Analysis groups

an_gp	Analysis Group
1	Mountains East, West & Central
2	Mountains Mid-West
3	Mountains Far-West
4	Rural Hills East
5	Rural Hills West
6	Rural Hills Central
7	Rural Hills Mid-West
8	Rural Hills Far-West
9	Rural Terai East
10	Rural Terai West
11	Rural Terai Central
12	Rural Terai Mid-West & Far-West


NEPAL 2010: fcs_FSM vs fcs_NLSS
fcs_FSM
fcs_NLSS
fcs_FSM
0
20
40
60
80
100
120


NEPAL fcs_FSM vs fcs_NLSS
an_gp1 = Mountains East, West & Central
fcs_FSM
fcs_NLSS
fcs_FSM
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
120.0



NEPAL fcs_FSM vs fac_NLSS
an_gp2 = Mountains Mid-West
fcs_FSM
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
10.0
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30.0
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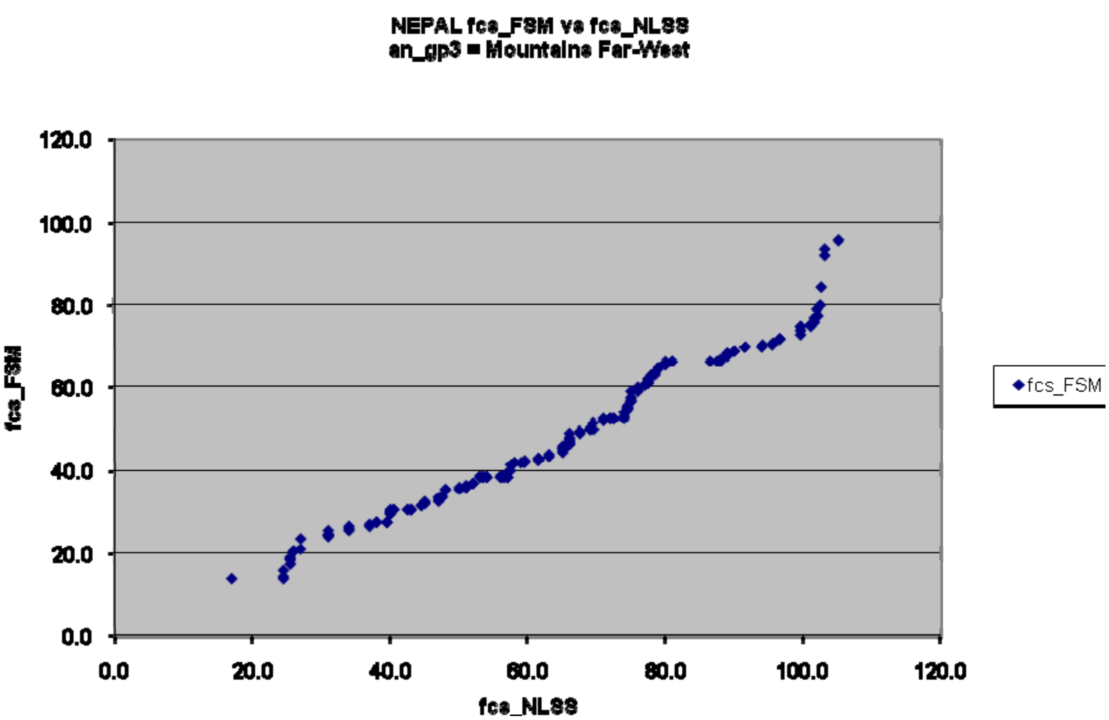
60.0
70.0
80.0
90.0
fcs_NLSS
fcs_FSM



NEPAL fcs_FSM vs fcs_NLSS
an_gp3 = Mountains Far-West
fcs_FSM
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
20.0
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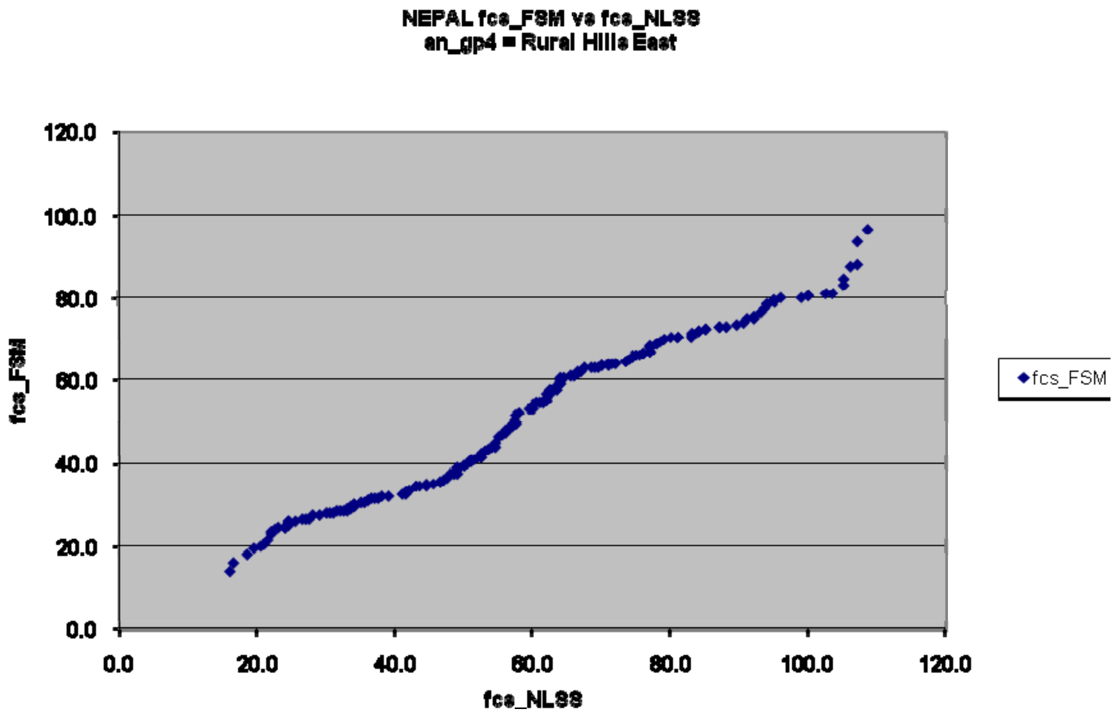
60.0
80.0
100.0
120.0
fcs_NLSS
fcs_FSM


NEPAL fcs_FSM vs fcs_NLSS
an_gp4 = Rural Hills East
fcs_FSM
fcs_NLSS
120.0
100.0
80.0
60.0
40.0
20.0
0.0
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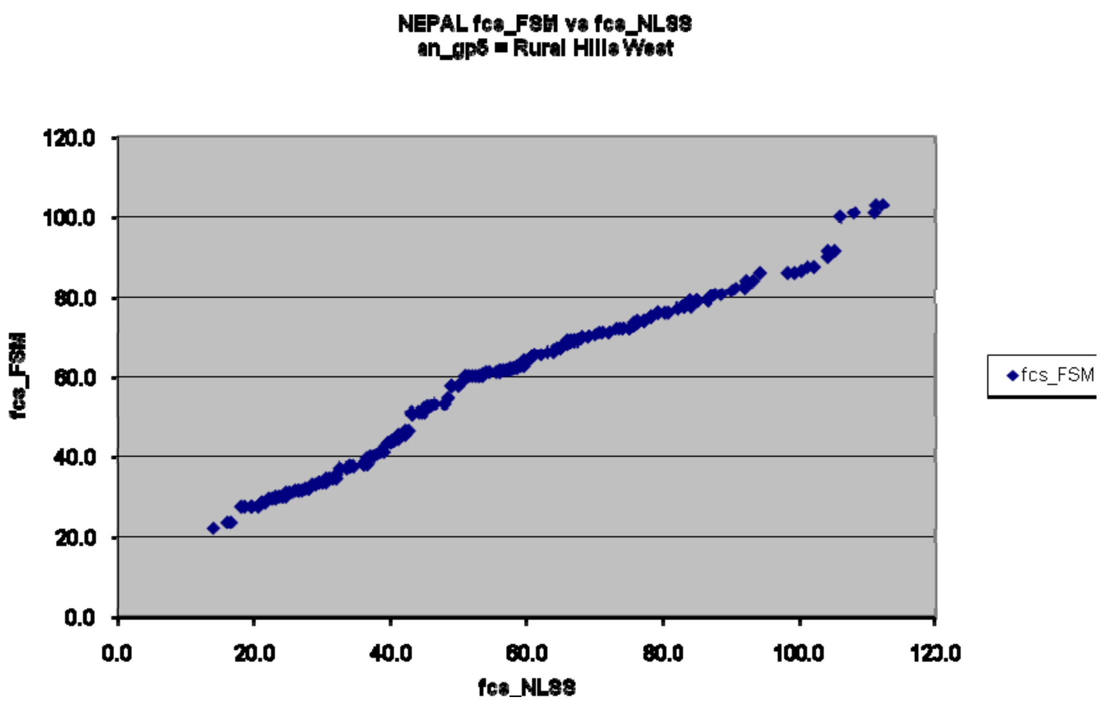
20.0
40.0
60.0
80.0
100.0
120.0
fcs_FSM


NEPAL fcs_FSM vs fcs_NLSS
an_gp5 = Rural Hills West
fcs_FSM
fcs_NLSS
120.0
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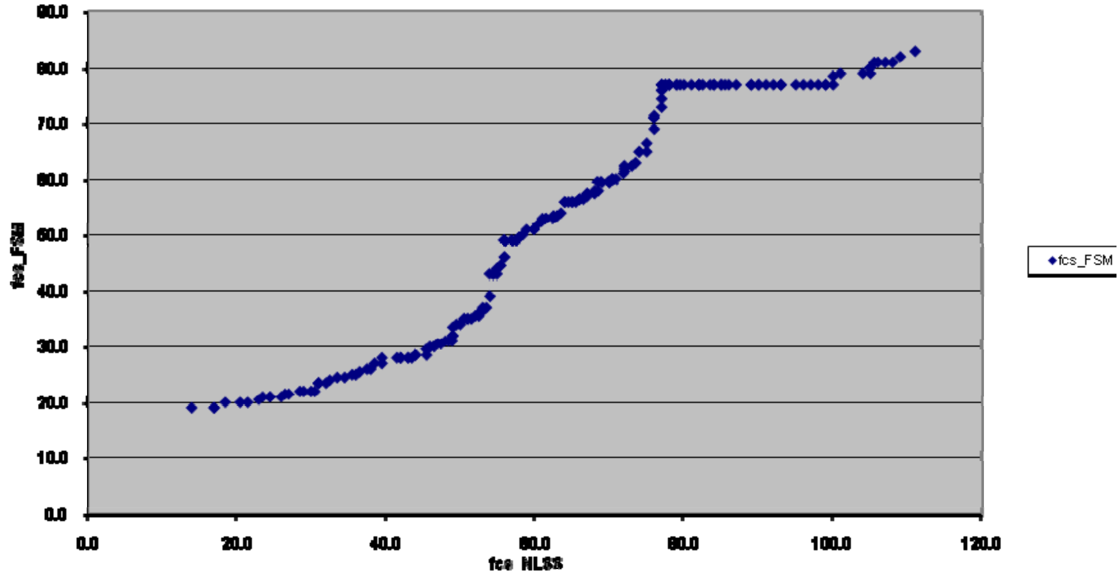
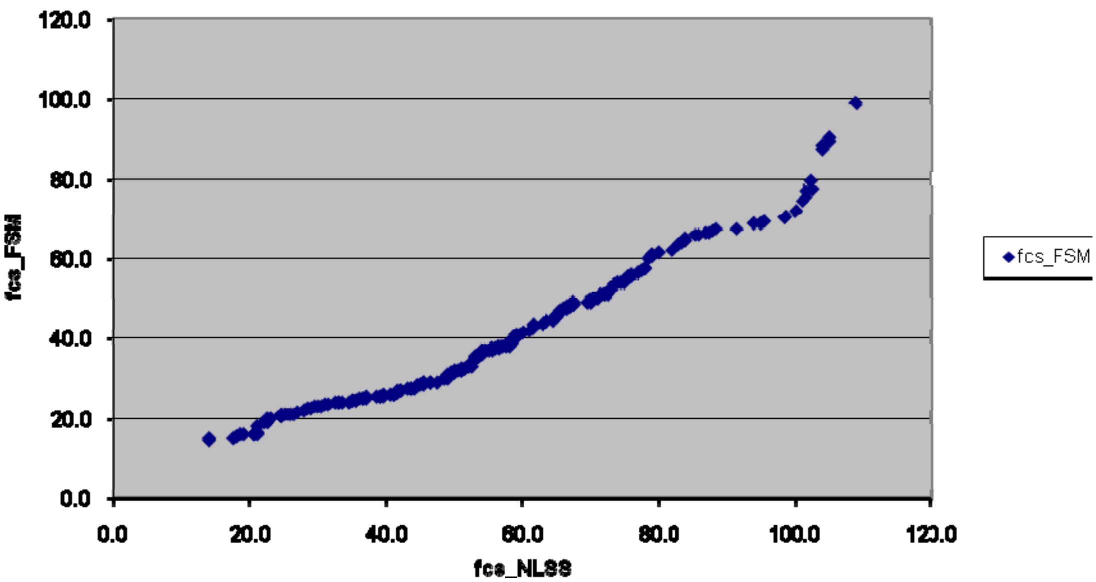
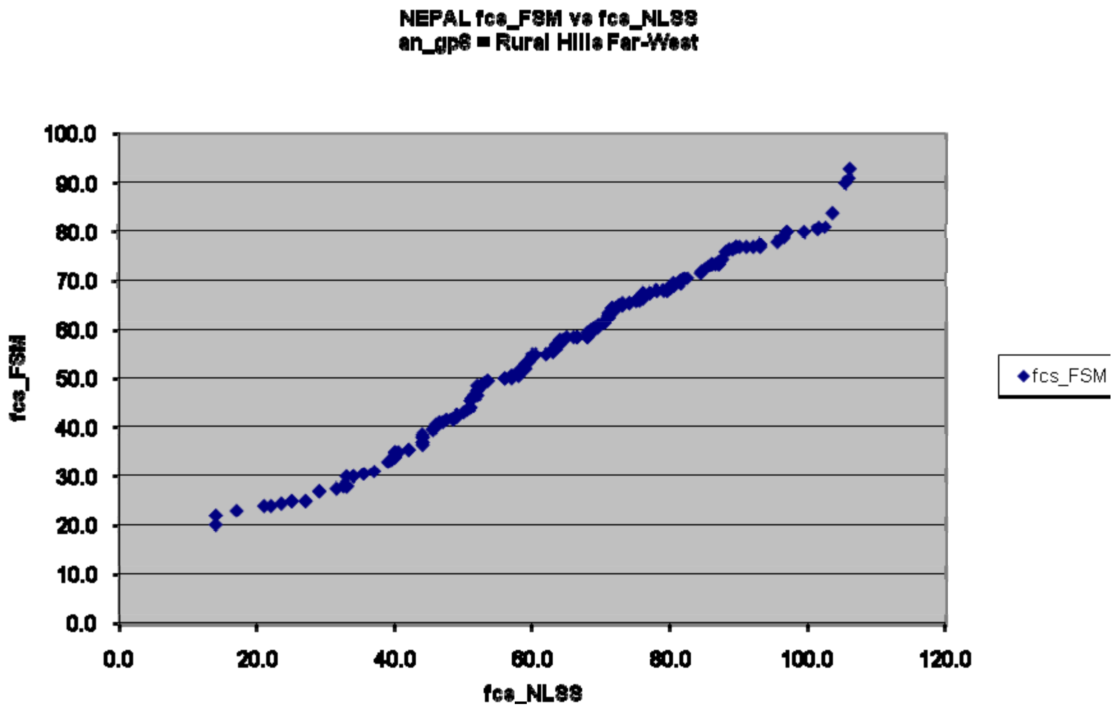
60.0
40.0
20.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
fcs_FSM

NEPAL fcs_FSM vs fcs_NLSS
an_gp6 = Rural Hills Central



NEPAL fcs_FSM vs fcs_NLSS
an_gp7 = Rural Hills Mid-West




NEPAL fcs_FSM vs fcs_NLSS
an_gp8 = Rural Hills Far-West
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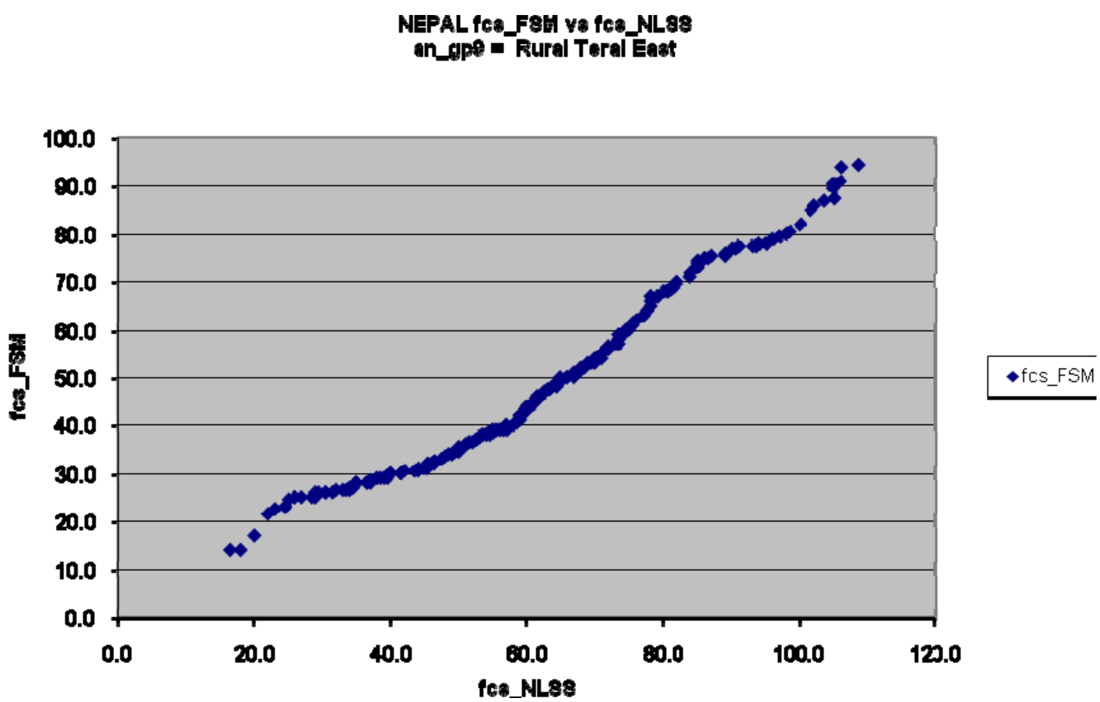
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
fcs_NLSS
fcs_FSM


NEPAL fcs_FSM vs fcs_NLSS
an_gp9 = Rural Terai East
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80.0
70.0
60.0
50.0
40.0
30.0
20.0
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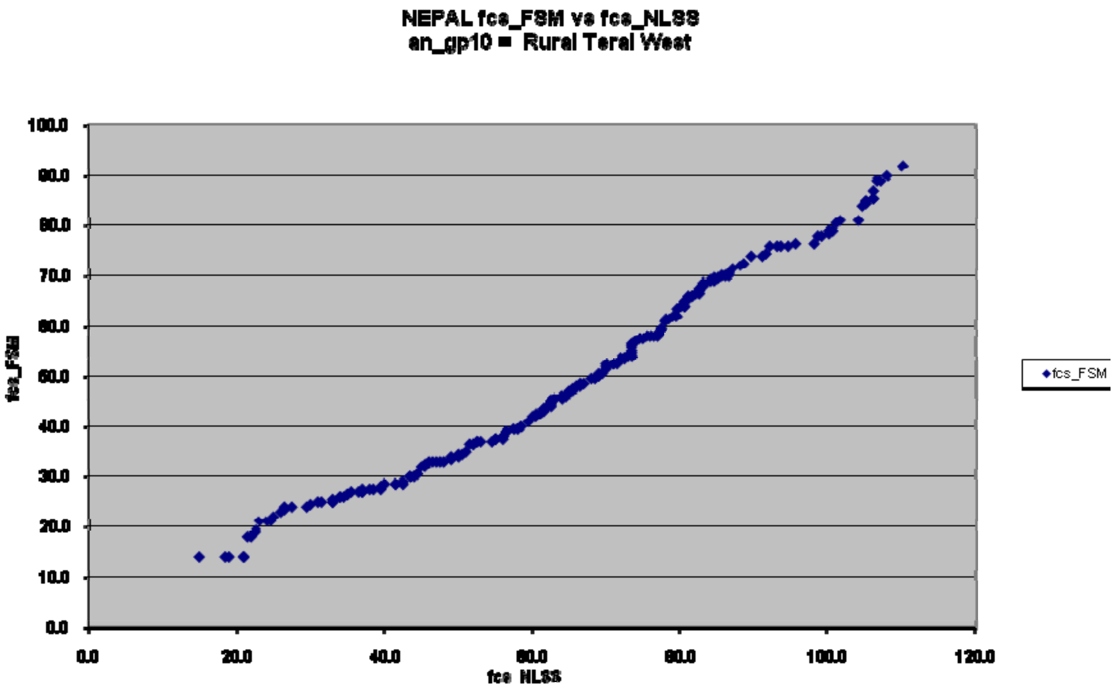
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
fcs_NLSS
fcs_FSM


NEPAL fcs_FSM vs fcs_NLSS
an_gp10 = Rural Terai West
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80.0
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60.0
50.0
40.0
30.0
20.0
10.0
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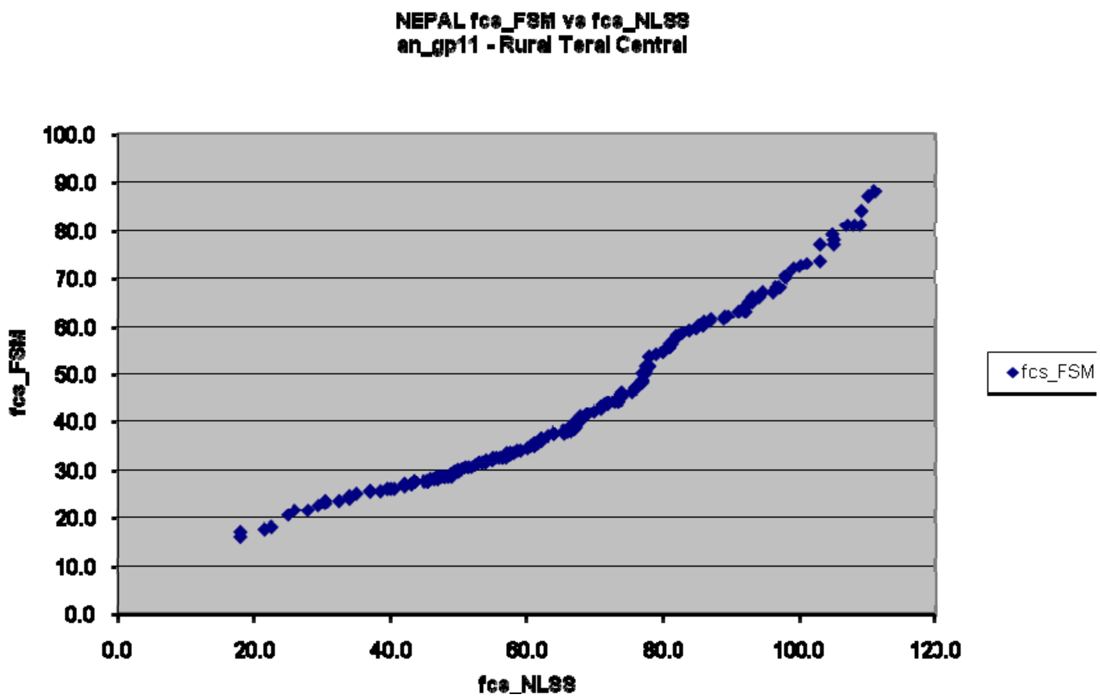
20.0
40.0
60.0
80.0
100.0
120.0
fcs NLSS
fcs_FSM


NEPAL fcs_FSM vs fcs_NLSS
an_gp11 - Rural Terai Central
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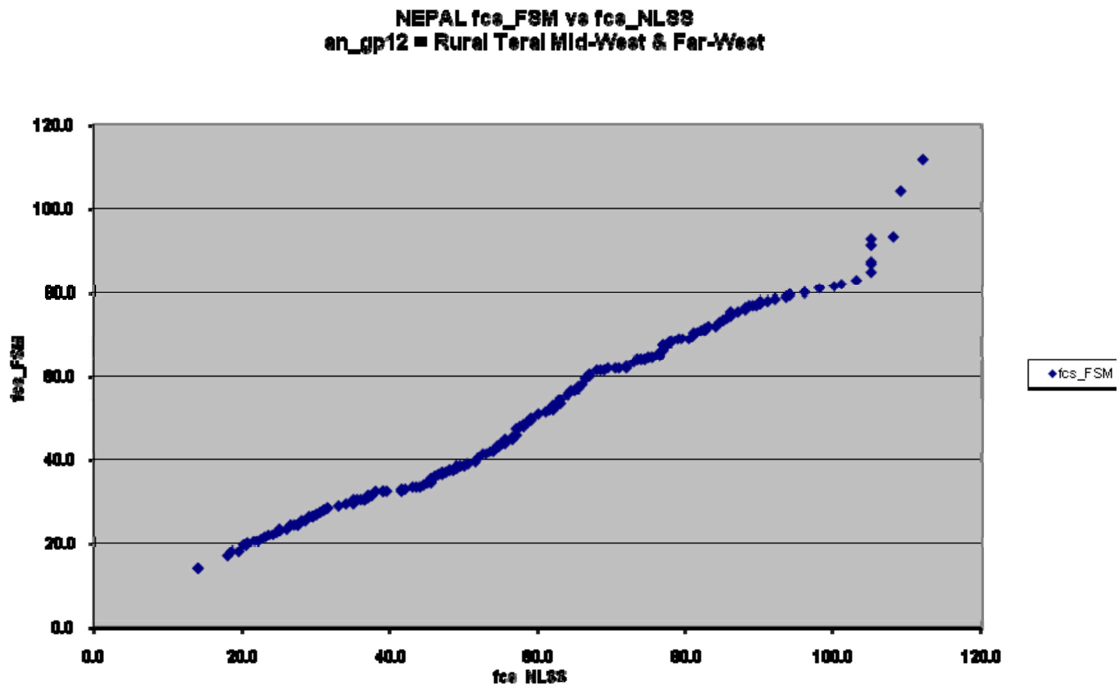
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
fcs_FSM
0.0
20.0
40.0
60.0
80.0
100.0
120.0
fcs_NLSS
fcs_FSM



The general conclusion is that there is no simple method of calibrating Food Consumption Score from NeKSAP with that from NLSS-III, because the relationship between the scoring systems used in the two surveys is markedly different. Further research may however be warranted, both on the general problem of calibrating such scores and on how best to resolve the calibration for these two Nepal surveys. However such an exercise remains beyond the scope of the current report.

Comparison of Coping Strategy Index from NLSS-III and the NeKSAP

Historically, Coping Index is derived from the 2011 NeKSAP questionnaire section 5, and from NLSS-III section 19, page 71.

However, statistical comparison on the coping index from NLSS-III and NeKSAP is not possible for two main reasons:

(a) The questions asked in the two surveys do not coincide. For example NeKSAP asks "Did your household reply on less preferred, less expensive food"; there is no such question in NLSS-III.
(b) The periods do not match, which raises a non-linearity issue similar to that for FCS. The period for NLSS-III is the "last 30 days"; those for NeKSAP are "Every day", "Less than 3 days a week", "More or equal to 3 days/week", "1-2 times a month" and "Never or very seldom". While "1-2 times a month" may correspond approximately to "in the last 30 days", the recall periods are different because the first does not refer specifically to the last 30 days.

Comparison of Edible Food Stock / Food Sufficiency from NLSS-III and the NeKSAP

NLSS-III asks only one general question in Section 19 about food stocks, NeKSAP many, so statistical comparison is not possible. Further the NLSS-III question is focused not on holdings, but on consumption of seed stocks under duress.

Comparison of Proportion of Total Expenditure on Food from NLSS-III and the NeKSAP

Again, statistical comparison is not possible because the NLSS-III questions (to the extent that they do match) include the value of food grown and consumed by the household, and the questions asked in NeKSAP 2010 and 2011 do not.

Comparison of Total land Owned from NLSS-III and the NeKSAP

Again, statistical comparison is not possible because the NLSS-III questions (to the extent that they do match) differ in scope. One includes land owned but not personally utilized (e.g. for reason of distance); the other does not. There are also a possible issue from the different area units used, and how they are related and recoded.

Comparison of Wealth Index from NLSS-III and the NeKSAP

Statistical comparison is not possible because the NLSS-III and NeKSAP questions do not match, e.g. NeKSAP asks about ownership of a wrist watch and a bullock cart, and NLSS-III does not. Using only common questions is a possibility that would limit this complication, but to do so would require a re-definition of wealth index for both surveys. Comparison with wealth indices on an international basis would be difficult for similar reasons.

There is also a technical issue. The calculation of wealth index involves putting the codes for all the constituent questions into binary or Bernoulli form in a way that, for each variable included, means “one” indicates a higher implied level of poverty than a “zero”. These scores are then analysed using principal component analysis (PCA). There is a statistical literature on this topic, because using binary variables to calculate the correlations used in PCA constrains the values of the correlations in ways that can distort the principal components. An interactive website illustrating this point called “Linear

Dependence between Two Bernoulli Random Variables" is available at: http://demonstrations.wolfram.com/LinearDependenceBetweenTwoBernoulliRandomVariables/

Further more detailed references to the underlying statistical complications are Lynne and McCulloch (2000), Rao and Joe (2006), and Lee and Huang (2010).

Comparison of Sources of Income from NLSS-III and the NeKSAP

It is extremely difficult to link the NeKSAP and NLSS-III questions on income. Firstly NLSS-III asks for total income, and NeKSAP for percentage contributions by type of income. Secondly, the details and categories covered do not coincide. Hence, statistical comparison is not possible.

Comparison of Crop Situation from NLSS-III and the NeKSAP

NLSS-III does not assess crop situation, so no statistical comparison of NLSS-III with NeKSAP is possible.

Comparison of Household Shocks from NLSS-III and the NeKSAP

NLSS-III does not assess household shocks so, as for crop situation, no statistical comparison of NLSS-III with NeKSAP is possible.

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APPENDIX 1

NeKSAP Household Food Security and Child Nutrition Monitoring Re-Design Sharing Workshop
Kathmandu, 19 January 2012

A half-day technical sharing workshop was organized on 19 January 2012 from 09:30 until lunch time to discuss the re-design of the NeKSAP Household Food Security and Child Nutrition Monitoring System at Yala Maya Kendra, Patan Dhoka, Lalitpur. A total of 25 participants attended the workshop (Appendix 3). The workshop was facilitated by Dr. Krishna Pahari, Advisor (Food Security Policy & Coordination), WFP.

The workshop schedule is attached (Annex).

The workshop started with a welcome address by Mr. Nicolas Oberlin, Deputy Country Director, WFP. He welcomed and thanked the participants for their presence and demonstration of keen interest in NeKSAP. He invited valuable suggestions from the participants and wished success to the workshop.

Presenting his few words, Mr. Bhaba N. Bhattarai, Joint Secretary, National Planning Commission, Government of Nepal, expressed his pleasure for the opportunity to attend the workshop. He talked about the ongoing collaborative work between the Government and WFP with regard to NeKSAP and mentioned that the Government is committed to providing support and policy guidelines for smooth implementation of NeKSAP. He expressed his satisfaction in being able to host the first consultation workshop held earlier. Since NPC is serving as the focal point for the Poverty Monitoring and Analysis System (PMAS) and since this system and NeKSAP are interconnected, there is need for closely coordinating these two systems. He finally thanked WFP for the invitation and wished that the workshop will be successful to achieve its objective.

The above expressions were followed by self-introduction around the table in which the participants introduced themselves also mentioning the agencies they represented.

Ms. Mariko Kawabata then made a presentation covering the following topics (see Annex).

Workshop objective:

To collect, consolidate, analyse food security data and to effectively communicate the results to decision makers in order to achieve coordinated, appropriate and timely action to prevent human suffering due to food insecurity.

NeKSAP setup:

Within the WFP, the system comprises a Central Analysis Unit working closely with the Food Security Monitoring Unit of the Ministry of Agriculture and Cooperatives, and District Food Security Network (DFSN) in 72 of the 75 districts at the field level. The

Central Analysis Unit consists of thematic experts, database management and GIS capacity supported by real-time, web-based data collection and analysis system. At the field level, 32 well trained and experienced Field Monitors are operating who are equipped with PDA and satellite phone with modem.

She presented a map showing the location of the Field Monitors with their heavier presence in the Mid- and Far-Western Regions, areas with higher occurrence of food insecurity.

Household food security monitoring:

The system collects information from more than 4,000 households per year. Data are collected on food security, child nutrition, WATSAN, migration. etc. Outputs of the system are quarterly food security report (FS Bulletin), and periodic information products by other thematic users (3F Crisis, Child Nutrition Bulletin).

She highlighted the monitoring redesign team and the process followed. She described the key features of the monitoring re-design mentioning that one of the purposes is to improve alignment with the Nepal Living Standards Survey (NLSS III) for the rural parts of Nepal, taking NLSS III as the baseline. She briefly mentioned the limitations and focus areas.

Sampling design: It is a rotation sampling design whereby 12 strata are selected. Wards within strata are selected with probability proportional to size using the 2011 Population Census as the sampling frame. Four rotation groups are sampled in each quarter (each rotation group contains two PSUs per stratum). Thus there 12 x 4 x 2 = 96 PSUs per quarter and 96 x 4 x 10 = 3,840 household visits per year. One child (6-59 months) per household is selected for the child nutrition module.

She explained the procedure followed in estimating indicators/variables of interest such as Food Security Score from each rotation group of based on the sampling design consists of from the include set up within the WFP, location of the field surveillance teams, focus area of the household food security monitoring system, the expert team and process of the monitoring re-design task, key features of the re-design, and its limitations and interests. She also described the sampling design, stratification, rotation pattern, and estimation procedure. She also highlighted the Information Management System (eWIN), data/information collection, outputs, data sets, real life examples, and vision for eWIN.

The next presentation was made by Dr Devendra Chapagain. It was about the indicators, various sections (modules) of the household questionnaire and the questions under each module. The questionnaire is divided into 17 modules each of which contains a number of relevant questions. The following are the indicators and corresponding modules.

S.N.	Indicators	Corresponding Module
1	Food Consumption Score (FCS) Food Consumption Group (FCG)	Module 9: Utilization-Food Consumption
2	Coping Strategies Index (CSI) prevalence of individual strategies	Module 4: Coping Strategies
3	Prevalence of household shocks	Module 3: Vulnerability
4	Calculated food sufficiency period	Module 6: Availability – Food stocks
5	Main crops, crop stage, production & outlook	Module 8: Access - Income source (current income)
6	Wealth index	Module 2: Household demographic & socio-economic status
7	Household profile	Module 2: Household demographic & socio-economic status
8	Source of food consumed	Module 9: Utilization – Food consumption
9	Prevalence of birth certificate	Module 12: Birth registration
10	Migration – Absenteeism rate	Module 16: Migration – Absentee information
11	Water treatment	Module 10: WASH
12	Place for hand washing, Availability of soap	Module 11: Hand washing
13	WFP programme participation	Module 14: Participation in WFP programme
14	Child Grant	Module 13: Child grant
15	Children under 5 disease prevalence rate	Child nutrition questionnaire
16	Use of oral rehydration therapy and Zinc tablets during the episode of diarrhea	Child nutrition questionnaire
17	Identification	Module 1: Monitoring cycle and sample

The initial plan to split the participants into groups and to ask each group to separately provide its feedback on the NeKSAP re-design presentations was altered in consultation with the participants and there was a consensus to continue the discussion in the plenary itself. In fact, questions and clarifications had already begun the presentations. This continued after all the presentations had been made.

The following were the questions raised by the participants and clarifications given by the WFP team:

- Some participants thought that the sample size of 4,000 households was small in order to be able to capture the wide variations across the strata in different geographical areas and ecological belts. It was explained that WFP's main focus has been on the food insecure areas and hence a larger sample size and heavier concentration of field monitors in such areas, such as the Mid- and Far-Western Regions. While the participants' concern is genuine this is what WFP could do given the resource limitations as explained in the presentation.

- While WFP is interested in the rural areas, food insecurity is prevalent also in urban areas. Besides, municipalities tend to possess more data that can be helpful in the analysis. Response to this concern was that high importance is given to food availability—availability is a constraint in rural areas while that is not the case in urban areas. The question was further pursued with the argument that there are other dimensions to food insecurity besides availability. It was explained that WFP preferred to maintain its focus on rural areas because those areas have limited alternative opportunities and greater vulnerability.
- In view of the resource limitations of WFP suggestion was made to forge partnership with other agencies within and outside the Government so that resources could be shared and supplemented. It was explained that working in partnership one of the guiding principles of WFP. There is an ongoing partnership with UNICEF in terms of financial support and with the Ministry of Agriculture and Cooperatives and its field network.
- Some participants wanted gender disaggregation of children. This was considered but the way the analysis is set up at present does not make use this separation.
- Some participants thought that sequencing of the modules was not orderly. The WFP team mentioned that this will be checked.
- In Module 15, the field monitors are asked to provide their perception about the socio-economic status of the respondent household. This is likely to be subjective. It has also been observed that in some strata well-off households were adopting heavier coping strategies. NLSS III asked the households themselves to provide their perceived status. Some participants suggested that some proxy or composite indicator could be developed instead to estimate this, which would be more accurate.
- A definitional point was raised to the effect that a household as defined in NLSS does not correspond with that in the NeKSAP. The WFP team will look at this and maintain uniformity.
- There was some discussion about including children <2 in the questionnaire. However, since UNICEF would like to focus on the age range of <5, it was agreed to keep it at <5.
- Regarding MUAC, some participants suggested that if a serious case is encountered, it should be referred to the nearest health post immediately. WFP, with technical support from the HKI, conducted a training for its fieldstaff on existing referral system for child acute malnutrition in 2010 to address this issue. It was suggested that a note would be inserted to guide the field monitors.
- Question on land ownership should be retained since this is an important variable to go into the household wealth index. Also, there is often a strong correlation between land ownership and poverty/food insecurity. Some participants opined that fragmentation of land is also important.
- Migration is often one of the coping strategies. Hence a question needs to be added to this effect in Module 4 Coping Strategies
- In the same module, the question about begging should be further rephrased to make it less offending.

- In Module 7 households are asked about this year's income and expenditure. It is not possible for a household to estimate current year's income. Hence the respondent should be asked to compare previous year's income with the year before that. Alternatively, it could be asked on a quarter to quarter basis.
- On Question 8 in Module 2 (caste/ethnicity), World Bank/UNDP apply a quite different classification. It was explained that NeKSAP is following the classification used in the NLSS.
- WFP should explore (and has already been exploring) the possibility of shortening the questionnaire by merging together similar questions where relevant.
- Information about the second main crop should be retained since for many households, the second crop can be quite important.
- There was a suggestion to make use of information available from other sources such as VDC profiles.

At the end of the workshop, the WFP staff presented a brief summary of the discussion and Ms Mariko Kawabata thanked all the participants for their active participation and valuable interventions.

The workshop was followed by lunch for all the participants.

The list of participants is given in Appendix 3.

Annex : Workshop Schedule

Date: 19 January 2012
Venue: Dokhaima Cafe, Patan Dhoka, Lalitpur

Time	Activity	Responsible Person
09:00-09:30	Registration, tea/coffee	
09:30-09:50	Opening - Welcome - Opening remark	Nicolas Oberlin, Deputy Country Director, WFP Bhaba Nath Bhattarai, Joint Secretary, Agriculture and Rural Development Division, NPC
09:50-10:20	Workshop objectives, brief introduction to the Household Food Security Monitoring Design	Marko Kawabata, WFP
10:20-11:00	Presentation on the indicators, tools	WFP team Devendra Chapagain, Abesh KC
11:00-12:30	Discussion on tool	Facilitator
12:30-12:40	Wrap-up and Vote of Thanks	Devendra Chapagain. Mariko Kawabata
12:40-	LUNCH	

APPENDIX 2

	GROUPING OF NLSS CASTE/ETHNICITY CODES			
Code	**Caste/Ethnicity Groups**	**Family Names**		**Remarks**
1	**Hill Brahmin**	Comprises the following family names listed in the Guidelines for Enumerators, National Agricultural Census 2012		
		1. Aryal 2. Acharya 3.Adhikari 4. Baral 5. Banskota	6. Bista 7. Bhattarai 8. Bhandari 9. Pokharel 10. Wagle	
		11. Dhakal 12. Dhungel 13. Dhital 14. Devkota	15. Gyawali 16. Ghimire 17. Joshi 18. Kharel	
		19. Khanal 20. Koirala 21. Upadhyaya 22. Regmi	23. Pandit 24. Basyal 25. Gairhe 26. [Missing]	
		27. Tiwari 28. Lamsal 29. Neupane 30. Sedhain	31. Rijal 32. Poudel 33. Subedi 34. Tmalsena	
		35. Marasini 36. Pandey 37. Silwal 38. Amgain	39. Chiluwal 40. Kandel 41. Pant 42. Baral 43. Tripathi	
		44. Ojha 45. Bhatta 46. Dahal 47. Gartaula 48. Sitaula	49. Dixit 50. Parajuli 51. Kadaria 52. Banjade 53. Belbase	
		54. Thapaliya 55. Sapkota 56. Basti 57. Awasthi 58. Nepal		
2	**Hill Chhetri**	1. Baniya 2. Budathoki 3. Barma 4. B. C. 5. Bohra 6. Dangi 7. Gharti Chhetri	8. Hamal 9. Katri Chhetri 10. Khadka 11. Khadayat 12. Khas 13. Karki	As per NAC 2012 Guidelines
		14. Khawas 15. Kuwar 16. Mahat 17. Rayamajhi 18. Rathaur	19. Rana Bhat 20. Sijapati 21. Thapa 22. Deuba 23. Ktwal 24. Basnet 25. Oli 26. Deuja	

	Thakuri	1. Chand 2. Malla 3. Palpali 4. Shah 5. Sen 6. Singh 7. Shahi 8. Thakuri 9. Rana 10. Rajput		NAC Guidelines treats Thakuri as a separate category.
3	**Terai Brahmin**	1. Burma 2. Sharma 3. Bhattacharya 4. Trivedi 5. Bangopadhyaya 11. Pathak 12. Jha 13. Mishra 14. Upadhyaya 15. Ojha 16. Thakur	6. Chattopadhyaya 7. Chaturvedi 8. Tripathi 9. Chaudhari 10. Dube	
4	**Terai Middle Caste**	1. Yadav 2. Teli 3. Koiri 4. Kurmi 5. Sonar 6. Kewat 7. Baniya 8. Mallah 9. Kalwar 17. Badhai 18. Barai 18. Kahar 19. Lodh 20. Rajbhar 21. Bing/Binda	10. Hajam/Thakur 11. Kanu 12. Sudhi 13. Lohar 14. Nuniya 15. Kumhar 16. Haluwai 22. Bhediyar 23. Mali	
5	**Hill Dalit**	1. Kami 2. Damai/Dholi 3. Sarki 4. Gaine 5. Other Dalit		
6	**Terai Dalit**	1. Chamar 2. Harijan 3. Ram 4. Musahar 5. Dusadh 6. Paswan 7. Tatma 8. Khatwe	9. Dhobi 10. Bantar 11. Dom 12. Dom 13. Halkhor	
7	**Newar**	1. Amatya/Mahaju 2. Balla 3. Buddhacharya/Bajracharya 4. Chitrakar 11. Malla 12. Maskey 13. Manandhar 14. Mulmi 15. Pradhan 16. Rajbhandari 23. Prajapati 24. Singh 25. Tamrakar 26. Awale 27. Bhuju 28. Malakar	5. Dangol/Maharjan 6. Dhakhwa 7. Hada 8. Joshi 9. Karmacharya 10. Kayastha 17. Sainju 18. Shakya 19. Shestha 20. Tuladhar 21. Devbhandari 22. Suwal	

8	**Hill Janjati**	1. Magar 2. Tamang 3. Rai 4. Gurung 5. Limbu 6. Sherpa 7. Gharti/Bhujel 8. Kumal 15. Yakkha 16. Darai 17. Thakali 18. Chhantal 19. Brahmu/Baramu	9. Sunuwar 10. Majhi 11. Danuwar 12. Chepang/Praja 13. Thami 14. Bhote 20. Lepcha 21. Raji 22. Raute	
9	**Terai Janjati**	1. Tharu 2. Dhanuk 3. Rajbansi 4. Santhal/Satar 5. Dhagar/Jhagar 6. Gangai	7. Dhimal 8. Tajpuriya	
10	**Muslim**			
11	**Others**	1. Marwadi 2. Bengali 3. Other caste		

APPENDIX 3

WFP-Nepal

NeKSAP Survey Redesign December 2011

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World Bank 8 December 2011

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National Planning Commission Secretariat - 16 December 2011

Bhaba Krishna Bhattarai (Joint Secretary)
Biju Kumar Shrestha (Program Director)

Sharing Workshop on Revised Monitoring Tool - January 19, 2012, Kathmandu

January 19, 2012, Kathmandu

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APPENDIX 4

Meetings with Government Agencies

National Planning Commission

Dr Krishna Pahari and the consultants Dr Stephen Haslett and Dr Devendra Chapagain visited NPC Secretariat and met with Mr. Bhaba Nath Bhattarai, Joint Secretary, Agriculture and Rural Development Division, and Mr. Biju Kumar Shrestha, Under Secretary on 16 December 2011.

The following points came from the meeting:

- The Government plans to institutionalise PMAS/DPMAS since NPC is charged with the responsibility of monitoring poverty and food security in the country.
- Since poverty monitoring and food security monitoring are interrelated, there is a need to foster collaboration between PMAS/DPMAS and NFSMAS-NeKSAP. In doing so, available resources should be utilised to complement each other and the working relationship between Government field staff and WFP field monitors should be enhanced.
- The Government wants to internalise both the systems and integrate food security and nutrition related information.
- NPC is strapped with resources. Suggestions to ease this constraint would be helpful.

Ministry of Agriculture and Cooperatives (MOAC)

The consultant, Dr Devendra Chapagain met Mr. Hem Raj Regmi, Senior Statistical Officer, Agribusiness Promotion and Statistics Division, on 1 January 2012. He has been designated as the national focal point for the Nepal Food Security Monitoring and Analysis System (NFSMAS). He provided the following information:

- NFSMAS was first piloted in 2006 in three eastern districts. It now covers 72 districts (excludes the three districts in the Kathmandu Valley).
- In each district, a District Food Security Network (DFSN) has been constituted. This network is chaired by the Chief District Officer (CDO) and MOAC has requested the Ministry of Local Development (MLD) through an official letter to designate the Local Development Officer (LDO), district level development coordinator, to serve as the Vice-Chair. In several districts, LDOs are already serving in that capacity.
- In each district identified as food-insecure, DFSN meets every three months while it meets every six months in food-secure districts. All the concerned stakeholders operating at the district level (government departments, I/NGOs, other agencies) attend these meetings, including WFP's Field Monitors.

- A new four-year project has been prepared for which the European Union has promised provide a grant of € 4 million in order to continue the activities initiated by NFSMAS. After completion of this project, MOAC is expected to fully own and continue the project activities.
- NFSMAS is a modified version of the Integrated Phase Classification (IPC) Framework supported by multiple donors in which eight UN agencies and INGOs participate. It operates at the global, regional and national levels. A number of countries have adopted this framework.
- NFSMAS focuses on food insecurity situation at the sub-district level. A total of 12 indicators have been developed for Nepal through stakeholder consultation at a workshop.
- The responsibility to implement NFSMAS rests primarily on the District Agricultural Development Offices (DADO) with technical and financial support from WFP. MOAC and WFP signed a Memorandum of Understanding for Strengthening of the Nepal Food Security Monitoring and Analysis System on 29 November 2010.
- There has been some discussion between the district level agricultural staff and MOAC regarding their respective roles in implementing DFSN. District-level staff consider it extra work without any additional incentive, even though the system has received support at the policy level. They are also to be given technical responsibilities not linked to fund mobilisation. The focal point unit at the Ministry holds a similar view. Sustainability of the project activities after discontinuation of external funds may need further consideration.
- MOAC is preparing another related project under the Global Agriculture and Food Security Programme (GAFSP), which is a multi-donor Trust Fund. It awarded Nepal with a grant of US$ 46.5 million in June 2011. The World Bank serves as the Supervising Entity (SE) for the proposed project. This project would comprise the following five components: (i) Technology development and adaption, (ii) Technology Dissemination and Adoption, (iii) Livelihood enhancement, (iv) Nutritional status enhancement, and (v) Project management.
- While MOAC attaches high priority to food security and supports efforts to regularly monitor its status, it lacks adequate expertise and financial resources to fully own and give continuation to NFSMAS. It did receive some essential equipment and training for its staff, but it feels that more support would be required.

Ministry of Health and Population

The consultant, Dr Devendra Chapagain visited MOHP on 1 January and the Department of Health Services (DHS) on 4 January 2012. At the Ministry, he met Ms. Sharada Pandey, who is Chief of the Environmental Health Programme within the Monitoring and Evaluation Division and also serves as the ministerial focal point for nutrition. The Ministry mostly uses the Demographic and Health Survey data and relies on information generated by I/NGOs for periodic monitoring of selected health and nutrition related matters. They similarly receive support from WHO, UNICEF and other development partners for technical and financial support.

The last Nutrition Survey was carried out in 1998 and the Ministry is considering to conduct a new survey in future.

At DHS, the consultant met Dr. Shyam Raj Upreti, Director, Child Health Division. He mentioned that the Department is presently focusing on stunting, underweight and wasting aspects of child nutrition. It however is considering to design a system for nutritional monitoring in future.

Ministry of Local Development

The consultant, Dr Devendra Chapagain, visited Dr. Raghu Nath Shrestha, Monitoring and Evaluation Specialist, Local Governance and Community Development Programme (LGCDP), a multi-donor initiative now covering all 75 districts of Nepal. Donors have committed US$ 201 million with an additional government counterpart contribution of US$ 500 million for the programme over a four year period.

The Poverty Monitoring and Analysis System (PMAS) and District Poverty Monitoring and Analysis System (DPMAS) is one of the support components of LGCDP. It is designed to regularly monitor implementation and outcome/impact of selected key sectoral programmes/sub-programmes related to poverty alleviation as outlined in the national Poverty Reduction Strategy. The areas selected for monitoring are: Health, drinking water and sanitation, education, rural infrastructure, economic activities (such as agriculture, livestock, forestry), targeted programmes, and capacity building.

At the district level, a DPMAS Committee has been constituted, which is chaired by the Local Development Officer and with members from the concerned government line agencies and other district level stakeholders. It carries out the implementation aspect of monitoring every trimester and outcome monitoring annually.

The system has so far provided computers, installed the analytical software, provided them training on the operation of the system, and provided 4-5 day training to one officer and one computer operator in each of the 75 districts. It has also given orientation to the district level stakeholders about DPMAS. These activities were conducted only recently and no monitoring reports have yet been produced.

UNICEF and UNFPA have provided NPR 50 thousand to each district in support of the system. It is a basket fund supported programme fully owned and managed by MLD and DDCs. Donor funds directly come to the Ministry, which is in full control of the resources. Both MLD officials and donors consider this to be a more sustainable approach than instances where the donors control the resources.

APPENDIX 5

Revised NeKSAP questionnaire