APPENDIX A: SAMPLE DESIGN FOR PAKISTAN SOCIAL AND LIVING STANDARDS MEASUREMENT SURVEY DISTRICT LEVEL, 2004-05

Objectives:

The data generated though PSLM Survey will be used to assist the government in formulating the poverty reduction strategy as well as development plans at district level. The indicators will be developed at district level in the following sectors.

1. Education
2. Health
3. Water Supply & Sanitation.
4. Household Assets/Amenities.
5. Satisfaction to Service Delivery.

Universe:

The universe of this survey consists of all urban and rural areas of all four provinces, Azad Jammu and Kashmir and FATA. Military restricted and protected areas of NWFP have been excluded from the scope of the survey.

SAMPLING FRAME

Urban area:

FBS has developed its own urban area frame. All urban areas comprising cities/ towns have been divided into small compact areas known as enumeration blocks (E.Bs) identifiable through map. Each enumeration block comprises about 200-250 households and categorized into low, middle and high-income group, keeping in view the socio economic status of the majority of households. Urban area sampling frame consists of 26698 enumeration blocks has been updated in 2003.

Rural area:

With regard to the rural areas, the lists of villages/mouzas/dehs according to Population Census, 1998 have been used as sampling frame. In this frame, each village/mouza/deh is identifiable by its Name, Had Bast Number, Cadastral map etc. This frame is comprised 50590 villages/mouzas

The number of enumeration blocks in urban and mouzas/dehs/villages in rural areas of the country are as under:

NO. OF ENUMERATION BLOCKS AND VILLAGES AS PER SAMPLING FRAME

Province	Number of E. Blocks	Number of Villages
Punjab	14,549	25,875
Sindh	9,025	5,871
NWFP	1,913	7,337
Balochistan	613	6,557
A.J.K	210	1,654
Northern Area	64	566
FATA		2,596
Islamabad	324	132
Total	**26,698**	**50,588**

STRATIFICATION PLAN

Urban Areas:

Within each district large sized cities having population five lacs and above have been treated as independent stratum. Each of these cities has further been sub-stratified into low, middle and high groups areas. The remaining cities/towns within each district have been grouped together to constitute an independent stratum. The entire AJ & K and Northern Areas have been treated as separate stratum respectively.

Rural Areas:

The entire rural domain of a district for Punjab, Sindh, NWFP and Balochistan provinces has been considered as independent stratum. All rural areas within AJ & K and Northern Areas have been adopted as independent stratum respectively.

Sample Size and its Allocation:

To determine optimum sample size for this survey, analytical studies based on the results of Pakistan Demographic Survey, Labour Force and Pakistan Integrated Households Sample Survey were undertaken. Keeping in view the variability exist within the population for the characteristics for which estimates are to be prepared, population distribution, level of estimates and field resources available a sample size of 76520 households enumerated from 5348 sample PSUs (2262 from urban and 3086 from rural areas) has been considered sufficient to produce reliable estimates at district level in respect of all provinces. An Annexure-I showing sample sizes by districts in four provinces of Pakistan, AJ&K and Northern Areas is attached.

Sample Design: A two-stage stratified sample design has been adopted for this survey.

Selection of primary sampling Units (PSUs):

Enumeration blocks in the urban domain and mouzas/dehs/villages in rural domain have been taken as primary sampling units (PSUs). In urban domain sample PSUs from each stratum have been selected by probability proportional to size (PPS) method of sampling scheme using households in each block as measure of size (MOS). Similarly in rural areas, population of each village has taken as MOS for selection of sample villages using probability proportional to size method of selection.

Selection of Secondary Sampling Units (SSUs):

Households within each sample Primary Sampling Unit (PSU) have been considered as Secondary Sampling Units (SSUs). 16 and 12 households have been selected from each sample village and enumeration block respectively by systematic sampling scheme with a random start.

Estimation Procedures:

Detail of estimation procedures for estimates and their variances is attached as Annexure – II.

District-Wise Distribution of Sample Areas _Villages and Enumeration Blocks) and Household – PSLM 2004-05

S.No	Districts	Sample Areas			Sample Households		
		Urban	Rural	Total	Urban	Rural	Total
	PUNJAB	1086	1182	2268	13032	18912	31944
1.	Attock	15	27	42	180	432	612
2.	Rawalpindi	72	36	108	864	576	1440
3.	Jhelum	15	24	39	180	384	564
4.	Chakwal	15	27	42	180	432	612
5.	Sargodha	39	39	78	468	624	1092
6.	Bhakkar	15	24	39	180	384	564
7.	Khushab	15	21	36	180	336	516
8.	Mianwali	15	21	36	180	336	516
9.	Faisalabad	102	69	171	1224	1104	2328
10.	Jhang	27	54	81	324	864	1188
11.	T.T.Singh	21	33	54	252	528	780
12.	Gujranwala	57	36	93	684	576	1260
13.	Gujrat	15	33	48	180	528	708
14.	Sialkot	36	21	57	432	336	768
15.	Hafiza Abad	15	27	42	180	432	612
16.	Mandi Bahauddin	15	27	42	180	432	612
17.	Narowal	15	30	45	180	480	660
18.	Lahore	219	27	246	2628	432	3060
19.	Kasur	27	42	69	324	672	996
20.	Okara	24	45	69	288	720	1008
21.	Sheikhupura	33	51	84	396	816	1212
22.	Vehari	15	42	57	180	672	852
23.	Sahiwal	15	36	51	180	576	756
24.	Multan	60	42	102	720	672	1392
25.	Khanewal	15	39	54	180	624	804
26.	Pakpattan	15	27	42	180	432	612
27.	Lodhran	15	21	36	180	336	516
28.	D.G.Khan	15	33	48	180	528	708
29.	Rajanpur	15	27	42	180	432	612
30.	Leiah	15	24	39	180	384	564
31.	Muzaffargarh	15	39	54	180	624	804
32.	Bahawalpur	39	42	81	468	672	1140
33.	Bahawalnagar	21	42	63	252	672	924
34.	R. Y. Khan	24	54	78	288	864	1152

	SINDH	**642**	**684**	**1326**	**7704**	**10944**	**18648**
1.	Khairpur	15	45	60	180	720	900
2.	Sukkur	39	21	60	468	336	804
3.	Nawab Shah	15	30	45	180	480	660
4.	Neshero Feroz	15	36	51	180	576	756
5.	Ghotki	15	36	51	180	576	756
6.	Jacobabad	20	45	65	240	720	960
7.	Shikarpur	15	30	45	180	480	660
8.	Larkana	20	60	80	240	960	1200
9.	Dadu	15	57	72	180	912	1092
10.	Hyderabad	57	60	117	684	960	1644
11.	Badin	15	45	60	180	720	900
12.	Thatta	15	48	63	180	768	948
13.	Sanghar	15	51	66	180	816	996
14.	Mirpur Khas	21	54	75	252	864	1116
15.	Tharparkar	12	39	51	144	624	768
16.	DISTRICT OF KARACHI	338	27	365	4056	432	4488
	N.W.F.P. TOTAL	**258**	**591**	**849**	**3096**	**9456**	**12552**
1.	SWAT	12	27	39	144	432	576
2.	UPPER DIR	5	26	31	60	416	476
3.	LOWER DIR	6	27	33	72	432	504
4.	CHITRAL	5	26	31	60	416	476
5.	SHANGLA	0	27	27	0	432	432
6.	MALAKAND	6	26	32	72	416	488
7.	BONAIR	0	30	30	0	480	480
8.	PESHAWAR	60	24	84	720	384	1104
9.	CHARSADA	14	22	36	168	352	520
10.	NOWSHERA	16	26	42	192	416	608
11.	KOHAT	14	24	38	168	384	552
12.	KARK	6	24	30	72	384	456
13.	HANGU	8	21	29	96	336	432
14.	D.I.KHAN	12	25	37	144	400	544
15.	TANK	6	20	26	72	320	392
16.	MANSEHRA	10	27	37	120	432	552
17.	ABBOTABAD	16	21	37	192	336	528
18.	BATAGRAM	0	27	27	0	432	432
19.	KOHISTAN	0	25	25	0	400	400
20.	HARIPUR	14	22	36	168	352	520
21.	BANNU	8	22	30	96	352	448
22.	LAKKI MARWAT	8	21	29	96	336	432
23.	MARDAN	18	27	45	216	432	648
24.	SWABI	14	24	38	168	384	552

	BALOCHISTAN TOTAL	195	521	716	2340	8336	10676
1.	QUETTA	45	21	66	540	336	876
2.	PASHIN	5	20	25	60	320	380
3.	QILLA ABDULLAH	7	20	27	84	320	404
4.	CHAGHI	8	20	28	96	320	416
5.	SIBBI	12	17	29	144	272	416
6.	ZIARAT	2	20	22	24	320	344
7.	KOHLU	2	20	22	24	320	344
8.	DERA BUGTI	4	19	23	48	304	352
9.	KALAT	6	20	26	72	320	392
10.	MASTUNG	8	20	28	96	320	416
11.	KHUZDAR	11	20	31	132	320	452
12.	AWARAN	0	20	20	0	320	320
13.	KHARAN	5	20	25	60	320	380
14.	LASBILLA	12	20	32	144	320	464
15.	KETCH/TURBAT	8	22	30	96	352	448
16.	GWADAR	12	14	26	144	224	368
17.	PANJGUR	5	21	26	60	336	396
18.	ZHOB	8	21	29	96	336	432
19.	LORALAI	6	21	27	72	336	408
20.	BARKHAN	2	20	22	24	320	344
21.	MUSA KHEL	0	22	22	0	352	352
22.	QILLAH SIAFULLAH	4	22	26	48	352	400
23.	NASIRABAD	6	21	27	72	336	408
24.	JAFARABAD	8	20	28	96	320	416
25.	JHAL MAGSI	2	20	22	24	320	344
26.	BOLAN/KACHHI	7	20	27	84	320	404
1.	ALL DISTRICTS OF AJ&K	36	57	93	432	912	1344
1.	ALL DISTRICTS OF NORTHERN AREAS	15	36	51	180	576	756
1.	ISLAMABAD	30	15	45	360	240	600
	PAKISTAN	2262	3086	5348	27144	49376	76520

Estimation Procedure:

ESTIMATION PROCEDURE ADOPTED FOR PSLM SURVEY

NOTATIONS:

N_h = Total number of Primary Sampling Units (PSUs) in the hth stratum of a province.

n_h = Total number of sample PSUs in the hth stratum of a province.

M_{hi} = Total number of Secondary Sampling Units (SSUs) in the ith sample PSU of hth stratum of a province.

m_{hi} = Number of sample SSUs in the ith sample PSU of hth stratum of a province.

P_{hi} = Assigned probability of selection of ith PSU of the hth stratum of a province.

y_{hij} = Value of any characteristic y of jth SSU within ith PSU of hth stratum of a province.

x_{hij} = Value of any characteristic x of jth SSU within ithPSU of hth stratum of a province with whose respect proportion is required.

(i): ESTIMATION FORMULAE FOR TOTALS AND THEIR VARIANCES

$$N = \sum_{h=1}^{L} N_h$$

$$n = \sum_{h=1}^{L} n_h$$

$$\overline{Y}_h = \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{\overline{Y}_{hi}}{p_{hi}}$$

OR

$$\overline{Y}_h = \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{1}{p_{hi}} \frac{M_{hi}}{m_{hi}} \sum_{j=1}^{m_{hi}} y_{hij}$$

$$\overline{Y} = \sum_{h=1}^{L} \overline{Y}_h = \sum_{h=1}^{L} \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{\overline{Y}_{hi}}{p_{hi}}$$

For X, another variable of interest, we have

$$\overline{\overline{x}}_h = \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{\overline{\overline{x}}_{hi}}{P_{hi}} = \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{1}{P_{hi}} \frac{M_{hi}}{m_{hi}} \sum_{j=1}^{m_{hi}} x_{hij}$$

$$\overline{\overline{x}} = \sum_{h=1}^{L} \overline{\overline{x}}_h = \sum_{h=1}^{L} \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{\overline{\overline{x}}_{hi}}{p_{hi}}$$

$$\overline{\overline{R}} = \frac{\overline{\overline{Y}}}{\overline{\overline{X}}}$$

$$v(\overline{\overline{y}}_h) = \frac{1}{n_h} s^2{}_{ht} = \frac{1}{n_h(n_h-1)} \left(\sum_{i=1}^{n_h} \frac{\overline{\overline{Y}}^2{}_{hi}}{P^2{}_{hi}} - \frac{\left(\sum_{i=1}^{n_h} \frac{\overline{\overline{y}}_{hi}}{P_{hi}} \right)^2}{n_h} \right)$$

$$v(\overline{\overline{Y}}) = \sum_{h=1}^{L} \frac{1}{n_h} s^2{}_{ht} = \sum_{h=1}^{L} \frac{1}{n_h(n_h-1)} \left(\sum_{i=1}^{n_h} \frac{\overline{\overline{Y}}^2{}_{hi}}{P^2{}_{hi}} - \frac{\left(\sum_{i=1}^{n_h} \frac{\overline{\overline{y}}_{hi}}{P_{hi}} \right)^2}{n_h} \right)$$

(ii): FORMULA FOR RATIO ESTIMATES

$$r = \frac{\overline{\overline{Y}}}{\overline{\overline{X}}}$$

where $Y^{\wedge}$ and $X^{\wedge}$ can be estimated by equations under item (i) given above.

$$Rel \ V(r) = \frac{1}{\overline{\overline{X}}^2} \sum_{h=1}^{L} \frac{1}{n_h} s^2{}_{hb} + \frac{1}{\overline{\overline{x}}^2} \sum_{h=1}^{L} \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{M^2{}_{hi}}{p^2{}_{hi} m_{hi}} \frac{\left(M_{hi} - m_{hi} \right)}{M_{hi}} s^2{}_{hw}$$

where

$$s^2{}_{hb} = s^2{}_{ht} - s^2{}_{hw}$$

$$s^2{}_{ht} = s^2{}_{hy} + r^2 s^2{}_{hx} - 2r \, s_{hxy}$$

$$s^2{}_{hx} = \frac{1}{(n_h-1)}\left[\sum_{i=1}^{n_h}\frac{\bar{x}^2{}_{hi}}{p^2{}_{hi}} - \frac{\left(\sum_{i=1}^{n_h}\frac{\bar{x}_{hi}}{p_{hi}}\right)^2}{n_h}\right]$$

$$s^2{}_{hy} = \frac{1}{(n_h-1)}\left[\sum_{i=1}^{n_h}\frac{\bar{y}^2{}_{hi}}{p^2{}_{hi}} - \frac{\left(\sum_{i=1}^{n_h}\frac{\bar{y}_{hi}}{p_{hi}}\right)^2}{n_h}\right]$$

$$s_{hxy} = \frac{1}{n_h-1}\left[\sum_{i=1}^{n_h}\left(\frac{\bar{x}_{hi}}{p_{hi}}\frac{\bar{y}_{hi}}{p_{hi}}\right) - \frac{\left(\sum_{i=1}^{n_h}\frac{\bar{x}_{hi}}{P_{hi}}\right)\left(\sum_{i=1}^{n_h}\frac{\bar{y}_{hi}}{P_{hi}}\right)}{n_h}\right]$$

$$s^2{}_{hw} = \frac{1}{n_h-1}\sum_{i=1}^{n_h}\frac{1}{p^2{}_{hi}}\frac{M^2{}_{hi}}{m_{hi}}\frac{(M_{hi}-m_{hi})}{M_{hi}}s^2{}_{hi}$$

and

$$s^2{}_{hi} = s^2{}_{hiy} + r^2 s^2{}_{hix} - 2r\, s_{hixy}$$

$$s^2_{hiy} = \frac{1}{(m_{hi} - 1)} \left[\sum_{j=1}^{m_{hi}} y^2_{hij} - \frac{\left(\sum_{j=1}^{m_{hi}} y_{hij} \right)^2}{m_{hi}} \right]$$

$$s^2_{hix} = \frac{1}{(m_{hi} - 1)} \left[\sum_{j=1}^{m_{hi}} x^2_{hij} - \frac{\left(\sum_{j=1}^{m_{hi}} x_{hij} \right)^2}{m_{hi}} \right]$$

$$s^2_{hixy} = \frac{1}{(m_{hi} - 1)} \left[\sum_{j=1}^{m_{hi}} x_{hij} \, y_{hij} - \frac{\left(\sum_{j=1}^{m_{hi}} x_{hij} \sum_{j=1}^{m_{hi}} y_{hij} \right)}{m_{hi}} \right]$$