APPENDIX A: SAMPLE DESIGN FOR PAKISTAN SOCIAL AND LIVING STANDARDS MEASUREMENT SURVEY DISTRICT LEVEL, 2008-09

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, 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 numbers 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 group's areas. The remaining cities/towns within each district have been grouped together to constitute an independent stratum.

Rural Areas:

The entire rural domain of a district for Punjab, Sindh, NWFP and Balochistan provinces has been considered as independent stratum.

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 75188 households enumerated from 5298 sample PSUs (2248 from urban and 3050 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, 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 and Household – PSLM 2008-09

S.No	Districts	Sample Areas			Sample Households		
		Urban	Rural	Total	Urban	Rural	Total
	PUNJAB TOTAL	1086	1182	2268	13031	18909	31940
101.	Attock	15	27	42	180	432	612
102.	Rawalpindi	72	36	108	864	576	1440
103.	Jhelum	15	24	39	180	384	564
104.	Chakwal	15	27	42	180	432	612
105.	Sargodha	39	39	78	468	624	1092
106.	Bhakkar	15	24	39	180	384	564
107.	Khushab	15	21	36	180	336	516
108.	Mianwali	15	21	36	180	333	513
109.	Faisalabad	102	69	171	1224	1104	2328
110.	Jhang	27	54	81	324	864	1188
111.	T.T.Singh	21	33	54	252	528	780
112.	Gujranwala	57	36	93	684	576	1260
113.	Gujrat	22	33	55	264	528	792
114.	Sialkot	36	21	57	432	336	768
115.	Hafiza Abad	15	27	42	180	432	612
116.	Mandi Bahauddin	15	27	42	180	432	612
117.	Narowal	15	30	45	180	480	660
118.	Lahore	208	27	235	2495	432	2927
119.	Kasur	27	42	69	324	672	996
120.	Okara	24	45	69	288	720	1008
121.	Sheikhupura	21	29	50	252	464	716
122.	Nankana Sahib	12	22	34	144	352	496
123.	Vehari	19	42	61	228	672	900
124.	Sahiwal	15	36	51	180	576	756
125.	Multan	56	42	98	672	672	1344
126.	Khanewal	15	39	54	180	624	804
127.	Pakpattan	15	27	42	180	432	612
128.	Lodhran	15	21	36	180	336	516
129.	D.G.Khan	19	33	52	228	528	756
130.	Rajanpur	15	27	42	180	432	612
131.	Leiah	15	24	39	180	384	564
132.	Muzaffargarh	15	39	54	180	624	804
133.	Bahawalpur	39	42	81	468	672	1140
134.	Bahawalnagar	21	42	63	252	672	924
135.	R. Y. Khan	24	54	78	288	864	1152

	SINDH **TOTAL**	**679**	**697**	**1376**	**8148**	**11152**	**19300**
201.	Khairpur	15	45	60	180	720	900
202.	Sukkur	39	21	60	468	336	804
203.	Nawab Shah	15	30	45	180	480	660
204.	Neshero Feroz	15	36	51	180	576	756
205.	Ghotki	15	36	51	180	576	756
206.	Jacobabad	11	24	35	132	384	516
207.	Kashmore	10	21	31	120	336	456
208.	Shikarpur	15	30	45	180	480	660
209.	Larkana	13	27	40	156	432	588
210.	Shahdadkot	7	33	40	84	528	612
211.	Dadu	10	38	48	120	608	728
212.	Jamshoro	15	19	34	180	304	484
213.	Hyderabad	48	18	66	576	288	864
214.	Matiari	10	20	30	120	320	440
215.	Tando Allah Yar	13	17	30	156	272	428
216.	Tando Muhd Khan	12	18	30	144	288	432
217.	Badin	15	45	60	180	720	900
218.	Thatta	15	48	63	180	768	948
219.	Sanghar	15	51	66	180	816	996
220.	Mirpur Khas	21	54	75	252	864	1116
221.	Tharparkar	12	39	51	144	624	768
222.	DISTRICT OF KARACHI	338	27	365	4056	432	4488
	Khyber Pakhtunkhwa **TOTAL**	**258**	**573**	**831**	**3096**	**9168**	**12264**
301.	SWAT	12	9	21	144	144	288
302.	UPPER DIR	5	26	31	60	416	476
303.	LOWER DIR	6	27	33	72	432	504
304.	CHITRAL	5	26	31	60	416	476
305.	SHANGLA	0	27	27	0	432	432
306.	MALAKAND	6	26	32	72	416	488
307.	BONAIR	0	30	30	0	480	480
308.	PESHAWAR	60	24	84	720	384	1104
309.	CHARSADA	14	22	36	168	352	520
310.	NOWSHERA	16	26	42	192	416	608
311.	KOHAT	14	24	38	168	384	552
312.	KARK	6	24	30	72	384	456
313.	HANGU	8	21	29	96	336	432
314.	D.I.KHAN	12	25	37	144	400	544
315.	TANK	6	20	26	72	320	392
316.	MANSEHRA	10	27	37	120	432	552
317.	ABBOTABAD	16	21	37	192	336	528
318.	BATAGRAM	0	27	27	0	432	432

319.	KOHISTAN	0	25	25	0	400	400
320.	HARIPUR	14	22	36	168	352	520
321.	BANNU	8	22	30	96	352	448
322.	LAKKI MARWAT	8	21	29	96	336	432
323.	MARDAN	18	27	45	216	432	648
324.	SWABI	14	24	38	168	384	552
	BALOCHISTAN TOTAL	**195**	**583**	**778**	**2340**	**9328**	**11668**
401.	QUETTA	45	21	66	540	336	876
402.	PASHIN	5	20	25	60	320	380
403.	QILLA ABDULLAH	8	20	28	96	320	416
404.	CHAGHI	3	22	25	36	352	388
405.	Nushki	4	24	28	48	384	432
406.	SIBBI	12	17	29	144	272	416
407.	ZIARAT	2	20	22	24	320	344
408.	KOHLU	2	20	22	24	320	344
409.	DERA BUGTI	4	19	23	48	304	352
410.	KALAT	6	20	26	72	320	392
411.	MASTUNG	8	20	28	96	320	416
412.	KHUZDAR	11	20	31	132	320	452
413.	AWARAN	0	20	20	0	320	320
414.	KHARAN	5	26	31	60	416	476
415.	Washuk	0	30	30	0	480	480
416.	LASBILLA	12	20	32	144	320	464
417.	KETCH/TURBAT	8	22	30	96	352	448
418.	GWADAR	12	14	26	144	224	368
419.	PANJGUR	5	21	26	60	336	396
420.	ZHOB	8	21	29	96	336	432
421.	LORALAI	6	21	27	72	336	408
422.	BARKHAN	2	20	22	24	320	344
423.	MUSA KHEL	0	22	22	0	352	352
424.	QILLAH SIAFULLAH	4	22	26	48	352	400
425.	NASIRABAD	6	21	27	72	336	408
426.	JAFARABAD	8	20	28	96	320	416
427.	JHAL MAGSI	2	20	22	24	320	344
428.	BOLAN/KACHHI	7	20	27	84	320	404
1.	ISLAMABAD	30	15	45	540	336	876
	PAKISTAN	**2248**	**3050**	**5298**	**26975**	**48797**	**75772**

Note: Non Contacted and Refusal households are included in the list of sample households.

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

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

$$\bar{\bar{X}} \;=\; \sum_{h=1}^{L} \bar{\bar{X}}_h \;=\; \sum_{h=1}^{L} \frac{1}{n_h} \sum_{i=1}^{n_h} \frac{\bar{\bar{X}}_{hi}}{p_{hi}}$$

$$\bar{\bar{R}} \;=\; \frac{\bar{\bar{Y}}}{\bar{\bar{X}}}$$

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

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

(ii): FORMULA FOR RATIO ESTIMATES

$$r \;=\; \frac{\bar{\bar{Y}}}{\bar{\bar{X}}}$$

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

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

where

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

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

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

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

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

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

and

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

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

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

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