A Resource Based Sampling Plan for ASI

B. B. Singh[1], National Sample Survey Office, FOD, New Delhi, India

Abstract

Annual Survey of Industries (ASI), despite having the mandates of self-compilation of returns by the units selected for the survey, most of the units require the support and expertise of the field functionaries for compilation. Responsibility of the survey for central sample including the census units rests with the Field Operations Division (FOD) of National Sample Survey Office (NSSO). The new sampling plan for the ASI envisages uniform sampling fraction for the sample units for the strata at State X district X sector X 4 digit NIC level, irrespective of the number of population units in each of the strata. Many strata have comparatively smaller number of population units requiring larger sampling fraction for better precision of estimates. On the other hand, a sizeable number of Regional Offices having the jurisdiction over a number of districts usually gets large allocation of sample units in individual strata beyond their managerial capacity with respect to availability of field functionaries and the work load, leading to increased non sampling errors. A plan based on varying sampling fraction ensuring a certain level of significance may result less number of units in these regions however still ensuring the estimates at desired precision. The sampling fraction in other strata having less number of population units could be increased so as to enhance the precision of the estimates in those strata. The latest ASI frames of units have been studied and a suitable sampling fraction has been suggested in the paper.

1.   Introduction

1.1   Annual Survey of Industries is the major source of Industrial Statistics in the organized sector of the country. It extends its coverage to the entire country except the States of Arunachal Pradesh, Mizoram and Union Territory of Lakshweep. Every year, ASI is conducted by the Central Statistics Office (CSO) with the responsibility of sample selection, data processing, analysis and report generation under the overall supervision of Standing Committee of Industrial Statistics (SCIS) constituted for providing technical guidance in the matter. The Field Operations Division (FOD) of National Sample Survey Office (NSSO) and the participating State Directorates of Economics and Statistics (DESs) collect, compile and scrutinize data from the factories in the field for the central sector and State sector respectively. ASI is a statutory scheme conducted under the Collection of Statistics Act and is based on self-compilation of returns by the selected factories, compiled from the balance sheets, profit & loss accounts and other records, as maintained by them. However, despite the provisions of the Act, returns are basically compiled only with the

_____
[1] e-mail: drbbsingh@hotmail.com

active support of field functionaries who visit the factories, discuss with them, refer the documents and actually compile the returns. The FOD has a network of field offices across the country with 6 zonal offices also working as training centres, 49 regional offices and 118 sub-regional offices, where primary responsibility of ASI rests on a particular grade of officers, viz. Superintending Officers (SO) with adequate experience, proper training and expertise to understand the balance sheets, profit & loss accounts and other records of the factories, to cull out information from the same and to prepare the returns following the concepts and definitions laid down for conducting ASI.

1.2   Recently, the CSO has revised the sample design with the primary aim of providing estimates of important industrial parameters at the lowest level of district (third tier of administrative governance in India after the Centre and States/Union Territories) and group of 4 digit of National Industrial Classification (NIC) and also with the desire/ necessity to generate such estimates quickly and adequately, based on central sector (compiled by FOD), without taking into account the state sector and to make central and state sector data easily pool able for better estimates. The sample design, however, focuses on one hand, the inclusion of census units (having 100 or more workers) for obvious purpose of netting the units with higher contribution in the sample and on other hand, the strata (district X 4 digit NIC) having less than or equal to 4 units so as to provide estimates of such strata on complete enumeration basis. For the rest of the frame units, it fixes normally an uniform sampling fraction (based on the overall resources available in the FOD/ State DESs) without taking into consideration of variability within and intra strata, adequacy of sampling fraction for the strata having more than 4 but less number of units, over representation of sample from the larger strata (say, having more than 100 units) and also the field reality in the sense of variability in manpower availability in the regional offices vis-à-vis the allocation of units under ASI with uniform sampling fraction.

1.3   The paper analyses the frame, discusses the adequacy of the sample design, strength of manpower in the field and provides some suggestions to get estimates with the same level of intended precision but reallocating the samples strata wise.

2.   The Sample Frame and Population Units

2.1   Annual Survey of Industries covers factories registered under the provisions of section 2m(i) and 2 m(ii) of the Factories Act, 1948, employing respectively, ten or more workers with electricity and twenty or more workers without electricity. It also covers bidi and cigar manufacturing establishments registered under the Bidi and Cigar Workers (Conditions of Employment) Act, 1966 and the public sector electricity undertakings engaged in generation, transmission and distribution of electricity and captive plants.
As such the survey covers three sectors, viz., factory, bidi and electricity, where factory/ workshop, establishment and undertaking/licensee are the respective unit of enumeration. The frame of ASI units is maintained by Chief Inspector of Factories (CIF) in respective State Governments, to whom, the factories are required to register themselves with minimum information on their locations, capacity and size of employment, etc. The frame is however, updated for ASI purpose by the FOD with updation of particulars for the factories surveyed in a particular ASI year, addition of newly registered factories in the frame and recommendations for deletion of the units found so, to CSO and to the CIF. The frame, as

far as economic parameters are concerned, has only the employee size which has been effectively utilized for stratification and sample selection.

2.2   The sample frame for ASI year 2011-12 has been analyzed for the study carried out in the paper. Here only the live units (no deleted units) have been considered. The distribution of units with respect to the size of workers, at all India level is summarized below in table – 1.

2.3   Distribution of units in the frame according to their employee size is highly skewed to the lower side of the tail, even if we consider only the units having employment size less than 100. Similar distribution is found for the units at State/ district/ 4 digit NIC level, the skewedness, differing slightly with respect to distinct 4 digit NIC group of industries. The frame contains 5.07% non-operating (NOP) units and 1% closed units. Closed units are those, which maintain staff but not having production and for which information on assets, employees etc. are available while the NOP are the units which remain closed for three consecutive years or has no production and not maintaining staff, however, information on assets made available. It is understood that a small fraction of NOP units, identified in the previous ASI year has been kept in the frame.

3.   Sample Design for ASI

3.1   The entire ASI has been divided into two parts, viz., central sample and state sample, the FOD to collect data entirely on central sample, while the State/ UT participate on the respective state samples. Central sample envisages two schemes, census and sample. The census scheme consists of the followings:

  i)   All industrial units belonging to six less industrially developed States/UTs, viz., Manipur, Meghalaya, Nagaland, Sikkim, Tripura and Andaman & Nicobar Islands.

  ii)   For the rest of 26 States/UTs, a) units having 100 or more workers, and b) all factories covered under Joint Returns.

  iii)   After excluding the census scheme units, as defined above, all units belonging to the strata (State X district X sector X 4 digit NIC) having less than 4 units.

3.2   Under the ASI, Joint return is compiled for the units located in the same State, having same management and belonging to same industry group at 4 digit level, for which separate unit wise accounts are not available. All the remaining units in the frame are considered under sample scheme meant for selection of sample both for the central (FOD) and state (DESs) agencies. Stratified circular systematic sampling technique is applied to choose the sample for this scheme. The factories are arranged in order of their number of employees and finally the sample is drawn circular systematically in the form of four independent sub samples considering an overall sampling fraction, say between 16% to 20% depending upon the availability of resources of FOD/ State. An even number of units with a minimum of 4 units are selected and evenly distributed in four sub-samples. Each of the 4 sub samples from a particular stratum may not have equal number of units. Out of these 4 sub-samples, 2 are assigned to FOD and the other 2 to State/UT for data collection.

State/UT will have to use census units, surveyed by central agency, along with their state sample while deriving district level estimates for their State/UT.

3.3   In the sample design adopted in earlier ASI years, the stratification was limited to State X sector X 4 digit NIC and the sample was drawn between 16% and 20% for the central sample. After selecting the central sample, rest of the ASI frame was treated as residual frame and was used for drawing the state samples. Stratification was done a fresh for the residual frame, the stratum consisting of district X 3 digit NIC for facilitating district level estimates by the interested State/UT. Within each stratum, samples were drawn circular systematically with sampling fraction of 10%, For West Bengal, the sampling fraction was taken as 17.5%.

3.4   The table-2 presents the summarized picture of number of strata and units in the census and sample sector. State wise and Regional Office wise units in the frame and their distribution in census and sample sector may be seen at Annexure-3 and Annexure-4 respectively. On an average, there are only a few units in each of the strata, making it necessary to take larger sample from the strata for better precision and thus increasing the overall sample size.

4.   Adequacy of sampling fraction taken in the Sample Design

4.1   It is not clear what sort of sub stratification at the strata level has been planned in the revised sample design, however, it is understood that this sub stratification have been done with respect to the employee size of the units in each of the strata. The units under the sample have been selected with 16% to 20% sampling fraction. The adequacy of sample to provide reliable estimates at district X 4 digit NIC level has been analyzed, based on grouping of the units belonging to each of the strata in 5 sub strata viz., <20 employees, 20-40 employees, 40-60 employees, 60-80 employees and 80-100 employees, with the lower limit included and the upper, excluded from the range and assuming 16% uniform fraction for each strata/ sub strata. The sub stratification for the strata has effectively reduced variability among units in sub strata. First four columns of table-3 provide mean employee size, their standard deviation and the coefficient of variation at all India level.

4.2   Employee size of all the units in the frame is available, which has been utilized for determining the sample size for each of the Strata. The sample design used by CSO is circular systematic and the sample size cannot be determined in such sampling technique. Therefore, sample size has been determined based on the assumptions that the selection of units has been carried out by simple random sampling without replacement (SRSWOR). It also has the basis of the permissible error i.e. the maximum difference (%) between the estimate and parameter value that can be tolerated and the confidence coefficient with which we want the estimate to lie within the permissible margin of error. The Relative Standard Error (RSE) of the sample mean,$\bar{y}$, based on a sample of n units selected with SRSWOR from the population size N, mean $\bar{Y}$ and standard deviation σ is given by

$$C(\bar{y}) = \sqrt{\frac{N-n}{N-1}} \frac{C}{\sqrt{n}} \qquad C = \frac{\sigma}{\bar{Y}}$$

where, C is the population Coefficient of Variation (CV). The sample size required to ensure an RSE of e% is given by

$$n = \frac{NC^2}{(N-1)e^2 + C^2}$$

4.3   The desired value of RSE $C(\bar{y})$ is fixed in such a way that the probability of the percentage difference between the estimate and the parameter being less than a prescribed value P_d is $1 - \alpha$ (=95% or 99%). Thus

$$Prob\{|\bar{y} - \bar{Y}| \leq d\} = 1 - \alpha \xrightarrow{yields} Prob\left\{\left|\frac{\bar{y}-\bar{Y}}{\bar{Y}}\right| \leq P_d\right\} = 1 - \alpha \qquad P_d = \frac{d}{\bar{Y}}$$

d is error (permissible) on either side of the parameter value, which means that an error of $100\, P_d$% on either side of the parameter value $\bar{Y}$ can be tolerated. If the sample size and the number of possible samples are fairly large, the sample mean is likely to be normally distributed with mean $\bar{Y}$ and standard deviation, $\sigma(\bar{Y})$.

$$Prob\left\{\frac{|\bar{y}-\bar{Y}|}{\sigma(\bar{y})} \leq k_\alpha\right\} = 1 - \alpha \xrightarrow{yields} Prob\left\{\left|\frac{\bar{y}-\bar{Y}}{\bar{Y}}\right| \leq k_\alpha C(\bar{y})\right\} = 1 - \alpha$$

Thus to ensure permissible error $100\, P_d$%, we should fix e as $e = {P_d}/{k_\alpha}$ which determines sample size

$$n = \frac{NC^2}{C^2 + (N-1)\frac{P_d^{\,2}}{k_\alpha^{\,2}}}$$

4.4   Here we have taken permissible margin of error of 10% (moderately high figure) at 95% desired level of confidence. The coefficient of variation for mean employee size for each of the strata and five sub strata in them have been calculated and the sample size for each of the strata determined and the total sample size calculated at State, Regional Office and all India level. Table-1 (column 6) presents the sample size required for desired precision of 10% in 5 sub strata at all India level. State wise and Regional Office wise number of units in the frame, sample as per the revised design and as calculated based on the requirements of 10% margin of error and 95% confidence coefficient have been presented in Annexure-3 and Annexure-4 respectively.

4.5   While calculating the sample size, it has been taken into account that at least one unit is selected from the sub strata having non zero units. It may be seen that all India level, the sample size required for reliable estimates at 10% margin of error is 84624 units

from the sample sector comprising of 171130 units against the meager sum of 39460 units with uniform sampling fraction of 16% as per the design. In case of 20% uniform sampling fraction, the sample size turns out to be 44630, which is still much lower to what is required for providing estimates at certain 10% margin of error.

4.6   The required sample size for the strata having 250 and more units have been particularly studied and found that sample design with 16% sampling fraction assigns more units for survey than desired/ required at 10% permissible errors and 95% level of confidence. All such strata with the related particulars of State, district and NIC 4 digit and the corresponding number of units in frame, sample size as per design and as calculated has been shown in Annexure-1 and the Regional Office wise the situation in Annexure-2 respectively. Table – 4 presents the summary at all India level. Such strata having 100 and more sample units are across 20 regional offices and 13 States.

5.   Overload of Field Offices

5.1   Data collection/ compilation of ASI is carried out by the SOs in the Field Operations Division of the NSSO. The sanctioned strength of the SOs is limited and therefore, it has always been debated between CSO and the FOD on how much sample size should be allocated for the central sample. For the last five years, sample size have been around 61-62 thousand units, however with the new sampling design and the objective of providing estimates at the district X 4 digit NIC level, sample size has been increased. Even at the lower limit of sampling fraction of 16%, the load of central sample comes out to be 67038, while it has been shown subsequently that with varying sampling fraction and by taking 8% fraction for the strata having 100 or more units, the sample size could be lowered to 64408 units as a total in the central sample, which may not affect the precision of the result adversely.

5.2   Sanctioned strength available in the Regional offices and work load there in terms of number of units per SO has been presented in Annexure-5 and summarized at all India level in Table-5. At all India level, the work load of units per SO engaged in ASI comes out to be 121. Data collection from visiting the factories and compilation of returns are carried out normally within 5 months from November to April and allocation of 121 average number of units per SO means he has to collect and compile six returns every week. Given the field problems, need of visiting some units more than once for getting the balance sheet, profit & loss accounts etc. made available to him and for consultation after compilation of returns, it becomes hectic for the SO to complete the ASI in time. Moreover there is wide difference of work load and availability of resources across the Regional Offices.

5.3   It may be emphasized that the SO is higher level responsibility in the field offices and the incharges of the sub regional offices and the coordinators for coordination of the schemes in the regional offices (comprising of 2-6 sub-regional offices) are drawn from this cadre. They also are primary field functionaries for the scheme on Agriculture statistics and the supervisory officers for the socio economic survey and price collection, urban frame survey and other ad-hoc or pilot surveys. They are multi functionary in nature and performance. They also work as trainers in the regional offices. Over engagement in ASI beyond the capacity of the SO not only affects the quality data for other schemes but also

increases the non- sampling errors in ASI compilation and the cases of NOP/ Deletion and the non-response due to non-adherence of the operational guidelines. As such, depending on varied work load in different regional offices, the availability of SO for the ASI work in a Regional Office, on an average comes out to be 40% of his entire engagement. In other way, given the sanctioned strength of a field offices, on an average only 40% SO can be effectively engaged in ASI work.

5.4   It may be seen from Annexure-5 that the Regional Offices having more than 60 units per SO (calculated based on total strength of SO irrespective of their involvement in ASI) face real problems as basically each of the SO carries out almost 150 ASI units in an ASI year (actual compilation for 6 months November-May). This overloads not only the SO for quick compilation but also creates problems for scrutiny. Normally such Regional Offices have the allocation of more than 2000 units, almost 20 strata having more than 100 units and samples with overall strata size being more than 6.00. The problems can be tackled by lowering the sampling fraction for the larger strata and thus maintaining desired level of precision.

5.5   There are some of the Regional Offices which have allocation of less than 30 units per SO, (actually meaning that they have 75 units per SO involved in the ASI) have less number of units allocated under the sample design which can be easily upped as they would be having the capabilities to conduct ASI for more units. Any sampling procedure requires comparatively larger sampling fraction for the smaller strata to achieve same level of precision in comparison to larger strata.

6.   Sampling Technique used in the Sample Design

6.1   The revised sample adopted is stratified circular systematic sampling with four sub samples, two sub samples, each for the central and state agencies. Systematic sampling is one of the most operationally convenient sampling. However, it has its own problems as it is not possible to estimate unbiasedly the variances of the estimators of population mean on the basis of a single sample. As such an estimate of sampling error cannot be provided. In the sample design, the problem has been tried to be solved by taking 4 systematic sub samples in each of the strata. However, still the problem persists. One has to strike a balance between the need for getting a good estimate of the population parameter and a good variance estimate. Sample design already has sub stratification in each of the strata and resultantly the variability among the units within the strata and sub strata have been largely reduced. Simple random sampling without replacement (SRSWOR) could be much better choice than the systematic sampling. Unbiased estimator of variance is available which may be utilized for calculating standard error. We may also reduce the number of sub samples to two, one for the central sample and another for state sample.

7.   Strata having Less than 4 Units

7.1   Revised sample design will be adopted from the ASI year 2012-13 with the purpose to provide reliable estimates at district X 4 digit NIC group level. In the process, as also followed earlier, all the strata having less than 4 units have been considered to be surveyed on complete enumeration basis. This may be desirable and the result will be accurate

without any sampling error. However, it has been found that as large as 1083 cases comprising of State X 4 digit NIC level with 1957 units exist. Obviously the scenario in the individual district and 4 digit NIC would be worse. We may have the problems in releasing results based on one or two units even at State level due to non-disclosure of identity clause in the Collection of Statistics Act and otherwise. It may be advised to merge with the related 4 digit industry groups in each of the corresponding districts of the State even for selection of units. This would also reduce the sample size to some extent and the results reportable.

8.   ASI Frame and Non Operating/ Deleted Units

8.1   As mentioned in earlier sections, ASI frame is maintained by the Chief Inspector of Factories in the States. They have the responsibilities of registration of new units, deregistration of non-existent units, incorporation of changes in location or industry group, employee size, plan capacity etc. Updation responsibility of FOD is limited to updation of particulars for the units under selection in a particular year. As sampling fraction for a particular year for the sample units hover around 16% to 20%, many units do not come under selection for almost five years. As such, data for employee size and to some extent even industry group, necessary for any selection exercise from the frame and the estimates based on sample and the multiplier may not be reliable to some extent. There was the time, when the work allocation of field functionaries were scheme specific, a set of SOs, involved only in ASI for the whole year, used to carry out the frame updation during 4-6 months, in the leisure time after compilation and dispatch of the ASI returns. However, now due to limited resources in the field offices, it has become difficult.

8.2   The frame of the units comprises closed and non-operating units, though limited to around 5%. However, every year, almost 15-20% units in the central sample itself get identified as NOP and deletion cases. This arises only due to non updation of frame. The CIF on their part, rarely updates the frame and deregisters the units. There is provisions of High Level Coordination Committee (HLCC) in each of the State, constituted under the Chairmanship of high level officer of the rank of Chief / Industrial Secretary in the State and having senior officers from the Department of Industry, Chief Inspector of Factories, Directorate of Economics & Statistics and the FOD of NSSO etc., however, in most of the States, either the meeting is not organized or the important subjects relating to frame not discussed properly. It is high time and beneficial for the industrial statistics that the frame is updated on annual basis by the CIF or minimum information on industrial category, employee size, location of the unit with some of the economic parameters, if possible is collected every year or at one time in 5 years by some agency. Then only the ASI and its results could be improved.

9.   Summary and Conclusions

9.1   ASI frame for the year 2011-12 has been analyzed along with the revised sample design adopted for the current ASI year 2012-13 and the results summarized. The employment size available in the frame for the purpose has been used for analysis.

i) The frame units have large variability within strata. Sub stratification based on employment size reduces the variability to a large extent. Sample size may be determined based on the priori knowledge about the variability and the precision of the estimates desired.

ii) Under the sample design, uniform sampling fraction has been fixed based on the availability of resources in the FOD and State DESs. The sampling fraction has been found inadequate for estimating the parameter with 10% permissible error and at 95% level of confidence. However, comparatively small sampling fraction for the large strata may be adequate for estimating the parameter with desired precision.

iii) FOD has the responsibility of data collection/ return compilation for all the census units and half of the sample units selected. The work load of FOD is much more than its resource availability. The work load vis-à-vis the allocation suggests reduction of allocation in the Regional Offices having more than 2000 units, having almost 20 strata with more than 100 units and samples with overall strata size being more than 6.00. In some of the Regional Offices having smaller number of units, the sample size may be increased.

iv) There are sizeable numbers of strata with 4 digit NIC group having 4 or less number of units at the State level. These strata may be merged with the related 4 digit industry groups in each of the corresponding districts of the State even for selection of units.

v) In systematic sampling, the variances of the estimators of population mean cannot be unbiasedly estimated on the basis of a single sample. Sample design already has sub stratification in each of the strata and resultantly the variability among the units within the strata and sub strata have been largely reduced. Simple random sampling without replacement (SRSWOR) could be much better choice than the systematic sampling.

vi) Proper frame updation is crucial for sample selection and obtaining better estimates. Almost 16% units of the selected sample in the central sector have been found relating to non-operating and deleted units. CIF may adopt a mechanism to routinely obtain the minimum information on changed location, ownership, industry group, employment size etc. from the registered units and update the frame on annual basis. Alternatively one time census of all the frame units (excepting the units under selection for the particular year) with minimum information on location, industry group, employee size and some of the economic parameters may be conducted.

References

Government of India (2013), "Instructions to field officials on Annual Survey of Industries (Concepts, Definitions and Procedures)", Government of India, Ministry of Statistics and Programme Implementations, Field Operations Division, NSSO and Central Statistics Office (Industrial Statistics Wing), August, 2013.

Government of India (2013), Annual Survey of Industries, 2010-11, Volume-I, Ministry of Statistics and Programme Implementations, Central Statistics Office (Industrial Statistics Wing), March, 2013.

Murthy M. N., Sampling Theory and Methods, Statistical Publishing Society, Kolkata.

Table - 1

Total	≤ 0	10-20	20-40	40-60	60-80	80-100	100-150
218438	27707	82830	48782	23760	9169	6527	5161

150-200	200-300	300-400	400-500	500-1000	1000-2000	2000-5000	≥5000
2932	3552	1906	1315	2687	1309	606	195

Table – 2

Annual Survey of Industries 2011-12

Average number of Units in Census/Sample Strata (Strata Size)

	Different cases	Strata	Units	Strata size
Total	All units	25421	218438	8.60
Census	Six less industrially developed States, Joint Return Units and other Strata with ≥100 workers	6550	24992	3.82
Census	Strata with ≤4 Units treated as Census	12508	22416	1.79
Sample	Strata with >4 Units constituting frame for selection of Sample Units	6363	171130	26.89

Table – 3

Sub Strata wise Number of Units and their Distribution and Sample Size

As Calculated for Desired Precision

Sub Strata	Units in Frame	Mean	Standard Deviation	Coefficient of Variation	Sample Calculated for desired precision
(1)	(2)	(3)	(4)	(5)	(6)
Overall	171330	21.55	20.54	95.29	84624
Less than 20 employees	94140	11.12	3.83	34.40	50134
20-40 employees	42970	25.64	5.87	22.88	21139
40-60 employees	20726	48.55	4.77	9.83	7259
60-80 employees	7807	67.97	5.79	8.52	3604
80-100 employees	5487	88.44	5.79	6.54	2488

Table – 4

Strata having >250 Units with Selected Sample Size and as Calculated for Desired Precision

No. of Strata	Total Units	Census	Sample frame	Selected-Design	Required-Calculated	Saving
72	35189	3623	31566	5092	4013	1079

Table-5

Work Load of Central Sample and Resources in FOD

Census Units	Sample Units		Central Sample Size (FOD)		Larger Strata	Resources in FOD		
Census	16% uniform sampling fraction	16% uniform and 8% for strata ≥100 units	16% sampling fraction	16% uniform and 8% for strata ≥100 units	Strata having ≥100 units	Sanctioned strength of SO	Units per SO	Units per SO engaged in ASI
47308	39460	67038	34200	64408	304	1389	48.26	121

Annexure - 1

Annual Survey of Industries 2011-12

List of Strata having ≥250 Sample Units with Sample Size as per Design and as Calculated
by Taking Employee Size as Size Measure and assuming SRSWOR

State		District		NIC 4 Digits	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Code	Name		Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3	Punjab	8	Fatehgarh Sahib	2410	280	13	267	44	52	-8
3	Punjab	9	Ludhiana	1311	287	29	258	42	55	-13
3	Punjab	9	Ludhiana	1430	720	53	667	108	62	46
3	Punjab	9	Ludhiana	3092	636	41	595	96	65	31
3	Punjab	16	Sangrur	1061	568	2	566	92	61	31
7	Delhi	9	South Delhi	1410	426	138	288	46	70	-24
8	Rajasthan	21	Ajmer	2396	294	1	293	48	28	20
8	Rajasthan	1	Ganganagar	2392	268	5	263	42	37	5
9	Uttar Pradesh	10	G Buddha Nagar	1410	664	190	474	76	45	31
10	Bihar	32	Rohtas	2396	343	0	343	56	6	50
19	West Bengal	9	Barddhaman	1061	287	0	287	46	35	11
24	Gujarat	7	Ahmedabad	2011	286	17	269	44	63	-19
24	Gujarat	7	Ahmedabad	2431	342	15	327	52	52	0
24	Gujarat	9	Rajkot	2392	362	3	359	58	44	14
24	Gujarat	22	Surat	1312	626	23	603	96	56	40
24	Gujarat	22	Surat	1313	460	184	276	44	57	-13
24	Gujarat	22	Surat	1399	336	26	310	50	74	-24
25	Daman & Diu	2	Daman	2220	949	48	901	144	56	88
26	D&N Haveli	1	D&N Haveli	2220	316	31	285	46	49	-3
27	Maharashtra	21	Thane	1311	353	33	320	52	48	4
27	Maharashtra	21	Thane	1313	361	68	293	48	44	4
27	Maharashtra	21	Thane	2100	341	54	287	46	54	-8
27	Maharashtra	21	Thane	2220	314	17	297	48	48	0
27	Maharashtra	21	Thane	2599	319	23	296	48	48	0
27	Maharashtra	22	Mumbai Suburban	1410	781	93	688	110	61	49
27	Maharashtra	22	Mumbai Suburban	1811	486	31	455	74	61	13
27	Maharashtra	22	Mumbai Suburban	2220	272	5	267	44	49	-5
27	Maharashtra	22	Mumbai Suburban	3211	795	227	568	92	59	33
27	Maharashtra	25	Pune	2930	553	148	405	66	55	11
28	Andhra Pradesh	17	Guntur	163	647	11	636	102	72	30
28	Andhra Pradesh	17	Guntur	1061	930	3	927	148	71	77
28	Andhra Pradesh	18	Prakasam	2396	618	5	613	98	63	35
28	Andhra Pradesh	19	Nellore	1061	316	0	316	52	59	-7
28	Andhra Pradesh	21	Kurnool	2396	567	1	566	92	49	43
28	Andhra Pradesh	23	Chittoor	2396	292	1	291	48	54	-6
28	Andhra Pradesh	2	Nizamabad	1061	358	8	350	56	58	-2
28	Andhra Pradesh	3	Karimnagar	1061	535	5	530	86	63	23
28	Andhra Pradesh	4	Medak	1061	278	2	276	44	57	-13
28	Andhra Pradesh	6	Rangareddy	1061	322	11	311	50	59	-9
28	Andhra Pradesh	6	Rangareddy	2100	295	31	264	42	61	-19

Annexure - 1- Concluded

Annual Survey of Industries 2011-12

List of Strata having ≥ 250 Sample Units with Sample Size as per Design and as Calculated
by Taking Employee Size as Size Measure and assuming SRSWOR

State		District		NIC 4 Digits	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Code	Name		Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
28	Andhra Pradesh	6	Rangareddy	2220	595	7	588	94	58	36
28	Andhra Pradesh	7	Mahbubnagar	1061	319	2	317	52	57	-5
28	Andhra Pradesh	8	Nalgonda	1061	310	4	306	50	66	-16
28	Andhra Pradesh	9	Warangal	1061	367	1	366	60	75	-15
28	Andhra Pradesh	10	Khammam	2396	620	1	619	100	70	30
28	Andhra Pradesh	11	Srikakulam	1061	256	0	256	42	45	-3
28	Andhra Pradesh	14	East Godavari	1061	450	3	447	72	60	12
28	Andhra Pradesh	15	West Godavari	1061	504	6	498	80	61	19
28	Andhra Pradesh	16	Krishna	1061	288	3	285	46	61	-15
29	Karnataka	20	Banglore	1410	734	402	332	54	52	2
29	Karnataka	20	Banglore	2220	286	33	253	40	61	-21
32	Kerala	1	Kasaragod	1200	305	24	281	46	33	13
32	Kerala	2	Kanur	1200	391	9	382	62	49	13
32	Kerala	7	Trissur	2392	302	1	301	48	51	-3
32	Kerala	13	Kollam	2392	327	0	327	52	42	10
33	Tamil Nadu	8	Salem	1062	284	0	284	46	79	-33
33	Tamil Nadu	9	Namakkal	1311	355	35	320	52	63	-11
33	Tamil Nadu	10	Erode	1311	411	38	373	60	61	-1
33	Tamil Nadu	12	Coimbatore	1311	773	77	696	112	71	41
33	Tamil Nadu	14	Karur	1392	370	25	345	56	64	-8
33	Tamil Nadu	32	Tiruppur	1311	564	57	507	82	63	19
33	Tamil Nadu	32	Tiruppur	1313	530	14	516	84	67	17
33	Tamil Nadu	32	Tiruppur	1391	1930	64	1866	300	90	210
33	Kerala	32	Tiruppur	1430	1452	370	1082	174	52	122
33	Tamil Nadu	1	Thiruvallur	1061	288	10	278	44	40	4
33	Tamil Nadu	1	Thiruvallur	2930	405	127	278	44	45	-1
33	Tamil Nadu	2	Chennai	1410	528	106	422	68	53	15
33	Tamil Nadu	4	Vellore	1511	541	75	466	76	55	21
33	Tamil Nadu	4	Vellore	1520	500	194	306	50	42	8
33	Tamil Nadu	27	Ramanathapuram	1811	437	26	411	66	51	15
33	Tamil Nadu	27	Ramanathapuram	2029	1135	188	947	152	66	86
33	Tamil Nadu	30	Kaniyakumari	1079	449	125	324	52	50	2
	Total				35189	3623	31566	5092	4013	1079

Annexure – 2

Annual Survey of Industries 2011-12

Regional Offices and State wise Strata with Size ≥ 250 Sample Units with Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure and assuming SRSWOR

State		Regional Office		No. of Strata	Units in Frame			Sample Size Design/Calculated		Saving
Code	Name	Strata	Name	Strata	Total	Census	Sample	Design	Calculated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3	Punjab	32	Ludhiana	5	2491	138	2353	382	295	87
7	Delhi	71	Delhi	1	426	138	288	46	70	-24
8	Rajasthan	81	Ajmer	1	294	1	293	48	28	20
8	Rajasthan	82	Jaipur	1	268	5	263	42	37	5
9	Uttar Pradesh	91	Agra	1	664	190	474	76	45	31
10	Bihar	102	Patna	1	343	0	343	56	6	50
19	West Bengal	191	Barddhaman	1	287	0	287	46	35	11
24	Gujarat	241	Ahmedabad	3	990	35	955	154	159	-5
24	Gujarat	242	Baroda	3	1422	233	1189	190	187	3
25	Daman & Diu	242	Baroda	1	949	48	901	144	56	88
26	D&N Haveli	242	Baroda	1	316	31	285	46	49	-3
27	Maharashtra	272	Mumbai	9	4022	551	3471	562	472	90
27	Maharashtra	274	Pune	1	553	148	405	66	55	11
28	Andhra Pradesh	281	Cuddapah	6	3370	21	3349	540	368	172
28	Andhra Pradesh	282	Hyderabad	10	3999	72	3927	634	624	10
28	Andhra Pradesh	283	Vijayawada	4	1498	12	1486	240	227	13
29	Karnataka	291	Banglore	2	1020	435	585	94	113	-19
32	Kerala	321	Kozhikode	3	998	34	964	156	133	23
32	Kerala	322	Thiruvananthapuram	1	327	0	327	52	42	10
33	Kerala	331	Coimbatore	9	6669	680	5989	966	610	356
33	Kerala	332	Chennai	5	2262	512	1750	282	235	47
33	Kerala	333	Madurai	3	2021	339	1682	270	167	103
	Total			72	35189	3623	31566	5092	4013	1079

Annexure – 3
Annual Survey of Industries 2011-12
State wise Units in Frame, their Distribution, Sample Size as per Design and as Calculated
by Taking Employee Size as Size Measure

State/UT		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Jammu & Kashmir	871	105	766	244	18.34	22.06	120.32	180	428
2	Himachal Pradesh	2523	408	2115	442	28.35	25.19	88.88	426	884
3	Punjab	12598	800	11798	969	24.33	19.83	81.53	2200	4258
4	Chandigarh	310	16	294	86	12.27	14.81	120.73	54	155
5	Uttarakhand	2851	597	2254	391	27.08	22.45	82.92	498	997
6	Haryana	6147	941	5206	1032	22.39	22.89	102.2	1144	2530
7	Delhi	3859	536	3323	573	19.55	20.3	103.89	752	1800
8	Rajasthan	8485	767	7718	1082	21.9	21.37	97.58	1550	3494
9	Uttar Pradesh	14127	1507	12620	2297	21.57	21.41	99.28	2722	6094
10	Bihar	3254	229	3025	608	19.71	24.13	122.41	612	1063
11	Sikkim	73	73	-	-	-	-	-	-	-
13	Nagaland	107	107	-	-	-	-	-	-	-
14	Manipur	117	117		-	-	-	-	-	-
16	Tripura	516	516	-	-	-	-	-	-	-
17	Meghalaya	112	112	-	-	-	-	-	-	-
18	Assam	3044	409	2635	610	23.03	25.79	111.98	544	1260
19	West Bengal	8432	979	7453	908	19.26	19.2	99.69	1668	3790
20	Jharkhand	2585	245	2340	532	20.36	21.35	104.89	486	981
21	Orissa	2717	291	2426	670	16.84	19.26	114.38	538	1136
22	Chhattisgarh	2491	316	2175	454	19.9	19.36	97.29	422	852
23	Madhya Pradesh	4311	615	3696	1222	15.66	19.59	125.14	792	1718
24	Gujarat	22251	1909	20342	1706	21.08	19.19	91.02	4210	9437
25	Daman & Diu	1957	190	1767	92	22.98	19.65	85.48	324	551
26	Dadar & Nagar Haveli	1489	214	1275	91	25.56	22.11	86.52	236	551
27	Maharashtra	28337	3510	24827	2085	22.32	19.81	88.75	4970	11009
28	Andhra Pradesh	27742	1392	26350	1593	17.38	16.48	94.83	5176	10540
29	Karnataka	11485	1876	9609	1414	23.53	22.42	95.27	2040	4862
30	Goa	595	145	450	174	20.14	24.99	124.06	112	212
32	Kerala	7051	964	6087	809	18.77	19.56	104.18	1300	2995
33	Tamil Nadu	37125	4841	32284	2181	24.51	21.77	88.85	6352	12660
34	Pondicherry	854	143	711	149	20.47	21.61	105.58	152	371
35	A & N Islans	22	22	-	-	-	-	-	-	-
	All India	218438	24892	193546	22414	21.55	20.54	95.29	39460	84628

Annexure – 4

Annual Survey of Industries 2011-12

Regional Office wise Units in Frame, their Distribution, Sample Size as per Design and as Calculated by Taking Employee Size as Size Measure

Regional Office		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
11	Jammu	755	92	663	158	20.64	22.48	108.93	168	413
12	Srinagar	116	13	103	86	3.51	10.61	302.03	12	15
21	Shimla	2523	408	2115	442	28.35	25.19	88.88	426	884
31	Jalandhar	4835	208	4627	470	22.78	19.41	85.22	880	2011
32	Ludhiana	7763	592	7171	499	25.32	20.04	79.12	1320	2247
41	Chandigarh (UT)	503	26	477	160	12.35	15.31	122.74	100	243
51	Dehradun	2851	597	2254	391	27.08	22.45	82.92	498	997
61	Chandigarh (Har)	5954	931	5023	958	22.76	23.02	101.15	1098	2442
71	Delhi	3859	536	3323	573	19.55	20.3	103.89	752	1800
81	Ajmer	3735	232	3503	544	16.69	17.75	106.35	672	1376
82	Jaipur	4750	535	4215	538	26.24	23.09	88.02	878	2118
91	Agra	7678	840	6838	742	24.18	21.25	87.87	1508	3371
92	Allahabad	1395	98	1297	535	13.18	18	136.63	284	555
93	Bareily	2460	357	2103	463	24.56	24.28	98.88	428	892
94	Lucknow	2594	212	2382	557	16.01	18.43	115.13	502	1276
101	Muzaffarpur	1228	118	1110	314	27.63	30.69	111.08	258	418
102	Patna	2026	111	1915	296	15.08	17.76	117.77	354	641
111	Gangatok	73	73	-	-	-	-	-	-	-
131	Kohima	107	107	-	-	-	-	-	-	-
141	Imphal	117	117	-	-	-	-	-	-	-
161	Agartala	516	516	-	-	-	-	-	-	-
171	Shillong	112	112	-	-	-	-	-	-	-
181	Guwahati	1348	103	1245	358	19.6	24.14	123.14	264	620
182	Dibrugah	1696	306	1390	252	26.1	26.81	102.73	280	640
191	Barddhaman	2108	271	1837	304	20.09	20.19	100.48	374	779
192	Kolkata	5307	535	4772	397	17.98	17.24	95.85	1130	2646
193	Maldah	1017	173	844	207	24.67	25.47	103.23	164	365
201	Ranchi	2585	245	2340	532	20.36	21.35	104.89	486	981
211	Bhubaneshwar	1521	150	1371	429	13.59	16.63	122.34	330	677
212	Sambalpur	1196	141	1055	241	21.05	21.49	102.09	208	459
221	Raipur	2491	316	2175	454	19.9	19.36	97.29	422	852
231	Bhopal	2671	297	2374	475	19.15	20.42	106.59	536	1242
232	Gwalior	971	132	839	485	9.49	17.08	179.92	168	300
233	Jabalpur	669	186	483	262	9.17	14.64	159.55	88	176
241	Ahmedabad	10785	659	10126	671	20.74	18.46	8.9007	2018	4360
242	Baroda	14912	1654	13258	1218	22.02	20.11	78.68	2752	6179

Annexure – 4 (Concluded)
Annual Survey of Industries 2011-12
Regional Office wise Units in Frame, their Distribution, Sample Size as per Design and as
Calculated by Taking Employee Size as Size Measure

Regional Office		Units in Frame			Strata Size	Distribution of Frame Sample Units			Sample Size Design/Calculated	
Code	Name	Total	Census	Sample	≤4	Mean	SD	CV	Design	Calculated
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
271	Aurangabad	4011	405	3606	536	20.64	19.64	95.17	806	1916
272	Mumbai	13732	1846	11886	257	23.31	19.07	81.83	2222	4504
273	Nagpur	2829	224	2605	488	18.21	18.8	103.23	536	1279
274	Pune	7765	1035	6730	804	23.06	21.24	92.09	1406	3310
281	Cuddapah	9166	297	8869	428	15.76	14.89	94.46	1680	3160
282	Hyderabad	12776	716	12060	692	18.43	17.13	92.92	2314	4810
283	Vijaywada	5852	384	5468	495	17.67	17.33	107.16	1194	2593
291	Banglore	8713	1651	7062	838	26.24	23.06	87.88	1434	3414
292	Hubli	2772	225	2547	576	16.01	18.56	115.92	606	1448
301	Panaji	595	145	450	174	20.14	24.99	124.06	112	212
321	Kozhikode	3456	176	3280	387	19.9	20.54	******	710	1525
322	Thiruvananthapuuram	3600	789	2811	426	17.43	18.25	104.69	590	1470
331	Coimbatore	17001	1509	15492	864	28.12	23.61	83.96	2968	5603
332	Chennai	11924	2412	9512	610	21.37	18.79	87.93	1924	4079
333	Madurai	8200	920	7280	707	20.93	20.06	95.81	1460	2978
341	Pondicherry	797	137	660	123	20.9	21.45	102.62	140	348
351	Port Blair	22	22	-	-	-	-	-	-	-
		218438	24892	193546	22416	21.55	20.54	95.29	39460	84624

Note: There are only 49 Regional Offices. Here Chandigarh (UT), Imphal, Agartala and Pondicherry have been shown separately. They are part of Chandigarh, Kohima, Shillong and Chennai Regional Offices, respectively

Annexure – 5
Annual Survey of Industries 2011-12
Regional Office wise load of units for Survey, Average Strata size and
Units per Field Functionaries (SO)

Regional Office		Census	Census Strata ⊴ units	16% Uniform Sample ≥4 Units		16% Sample, 8% for Strata size ≥100 units		No of Strata with Size		Strata Size	Superintending Officers	
Code	Name			Sample	Total	Sample	Total	≥4	≥100		Strength	Units/ S O
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
11	Jammu	92	158	168	334	168	334	40	-	4.20	14	23.86
12	Srinagar	13	86	12	105	12	105	3	-	4.00	7	15.00
21	Shimla	408	442	426	1063	390	1045	83	3	5.13	27	39.37
31	Jalandhar	208	470	880	1118	762	1059	127	9	6.93	20	55.90
32	Ludhiana	592	499	1320	1751	968	1575	141	18	9.36	37	47.32
51	Dehradun	597	391	498	1237	466	1221	97	3	5.13	24	51.54
61	Chandigarh	957	1118	1198	2674	1122	2636	243	6	4.93	47	56.89
71	Delhi	536	573	752	1485	718	1468	150	2	5.01	18	82.50
81	Ajmer	232	544	672	1112	556	1054	104	8	6.46	28	39.71
82	Jaipur	535	538	878	1512	800	1473	162	7	5.42	37	40.86
91	Agra	840	742	1508	2336	1412	2288	283	6	5.33	38	61.47
92	Allahabad	98	535	284	775	284	775	67	-	4.24	39	19.87
93	Bareily	357	463	428	1034	414	1027	83	1	5.16	30	34.47
94	Lucknow	212	557	502	1020	492	1015	108	1	4.65	40	25.50
101	Muzaffarpur	118	314	258	561	248	556	58	1	4.45	27	20.78
102	Patna	111	296	354	584	292	553	55	4	6.44	21	27.81
111	Gangatok	73	-	-	73	0	73	-	-	-	2	36.50
131	Kohima	107	-	-	107	0	107	-	-	-	4	26.75
141	Imphal	117	-	-	117	0	117	-	-	-	3	39.00
161	Agartala	516	-	-	516	0	516	-	-	-	4	
171	Shillong	112	-	-	112	0	112	-	-	-	6	18.67
181	Guwahati	103	358	264	593	264	593	60	-	4.40	17	34.88
182	Dibrugah	306	252	280	698	280	698	54	-	5.19	25	27.92
191	Barddhaman	271	304	374	762	344	747	65	2	5.75	25	30.48
192	Kolkata	535	397	1130	1497	1058	1461	218	6	5.18	34	44.03
193	Maldah	173	207	164	462	154	457	30	1	5.47	20	23.10
201	Ranchi	245	532	486	1020	456	1005	96	2	5.06	24	42.50
211	Bhubaneshwar	150	429	330	744	330	744	76	-	4.34	22	33.82
212	Sambalpur	141	241	208	486	208	486	39	-	5.33	18	27.00
221	Raipur	316	454	422	981	362	951	68	5	6.21	28	35.04
231	Bhopal	297	475	536	1040	504	1024	107	3	5.01	27	38.52
232	Gwalior	132	485	168	701	168	701	42	-	4.00	27	25.96
233	Jabalpur	186	262	88	492	88	492	22	-	4.00	19	25.89
241	Ahmedabad	659	671	2018	2339	1698	2179	299	25	6.75	44	53.16

Annexure – 5 (Concluded)
Annual Survey of Industries 2011-12
Regional Office wise load of units for Survey, Average Strata size and
Units per Field Functionaries (SO)

Regional Office		Census	Census Strata ≤ units	16% Uniform Sample ≥4 Units		16% Sample, 8% for Strata size ≥100 units		No of Strata with Size		Strata Size	Superintending Officers	
Code	Name			Sam-ple	Total	Sam-ple	Total	≥4	≥100		Stren-gth	Units/S O
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
242	Baroda	1654	1218	2752	4248	2404	4074	451	20	6.10	63	67.43
271	Aurangabad	405	536	806	1344	770	1326	157	4	5.13	29	46.34
272	Mumbai	1846	257	2222	3214	1700	2953	247	30	9.00	41	78.39
273	Nagpur	224	488	536	980	518	971	105	2	5.10	27	36.30
274	Pune	1035	804	1406	2542	1242	2460	248	12	5.67	37	68.70
281	Cuddapah	297	428	1680	1565	1278	1364	184	17	9.13	36	43.47
282	Hyderabad	716	692	2314	2565	1848	2332	289	23	8.01	42	61.07
283	Vijaywada	384	495	1194	1476	1064	1411	210	5	5.69	26	56.17
291	Banglore	1651	838	1434	3206	1228	3103	233	15	6.15	52	61.65
292	Hubli	225	576	606	1104	568	1085	126	4	4.81	34	32.47
301	Panaji	145	174	112	375	112	375	28	-	4.00	7	53.57
321	Kozhikode	176	387	710	918	624	875	122	4	5.82	24	38.25
322	Thiruvananthapuuram	789	426	590	1510	554	1492	108	2	5.46	26	58.08
331	Coimbatore	1509	864	2968	3857	2286	3516	343	23	8.65	50	77.14
332	Chennai	2412	610	1924	3984	1610	3827	285	20	6.75	47	84.77
333	Madurai	920	707	1460	2357	1248	2251	220	9	6.64	35	67.34
341	Pondicherry	137	123	140	330	128	324	27	1	5.19	7	47.14
351	Port Blair	22	-	-	22	-	22	-	-	-	3	7.33
		24892	22416	39460	67038	34200	64408	6363	304	6.20	1389	48.26

Note: There are only 49 Regional Offices. Here Chandigarh (UT), Imphal, Agartala and Pondicherry have been shown separately. They are part of Chandigarh, Kohima, Shillong and Chennai Regional Offices, respectively.