Article 4 of 6

A representative sample

What the Standard says

Section 8 of ISO 9001:2000 covers *"measurement, analysis and improvement"*. Although sampling is not specifically covered by the Standard, clause 8.1, the general introduction to the measurement section specifies that measurement, analysis and improvement activities *"shall include determination of applicable methods, including statistical techniques, and the extent of their use".* An accurate measure of customer satisfaction will be generated only if it is based on a statistically robust sample of customers. However, the technical aspects of achieving a robust sample are poorly understood and often neglected This article will review the four main sampling principles that should be followed in order to achieve that objective.

1. Random sampling to eliminate bias

This is the most important principle behind reliable sampling. Only a random sample will guarantee an unbiased result. The definition of a random (or probability) sample is that every member of the population concerned should stand an equal chance of ending up in the sample, hence no bias. The National Lottery is a good example of a random sample. Every ball remaining in Arthur, Guinevere or Merlin stands an equal chance of being the next ball to be selected. This is OK for small sample sizes but to randomly select each member of a large sample from those remaining on the list would be very time consuming. To save time it is perfectly acceptable to use a

systematic random sample. To do this first determine your sampling fraction – the total number in your sampling frame (i.e. your customer base) divided by the required number in the sample. If you have 1000 customers and need a sample of 100 your sampling fraction would be 1 in 10. Next draw a number at random between 1 and 10. If the randomly generated number happened to be 6, you should select the 6th name on the list and every 10th name thereafter. Name number 996 on the list will be the final and 100th name in your sample. Before drawing that random number, every customer on the list stood an equal chance of ending up in the sample, so this is a random and therefore unbiased sample. However, it may not be representative, particularly for companies in business-to-business markets, which typically have a customer base reflecting the Pareto principle, a small number of customers accounting for a large proportion of the company's business.

2. Stratified random sampling to reflect customer value

Let's say your top 6 customers account for 50% of turnover. The systematic random sample outlined above could quite easily fail to pick up any of those top 6 customers, leading to a survey that ignores 50% of everything your business does. Hardly representative! To eliminate this risk and achieve a sample that is representative as well as random you need a stratified random sample. First divide your database into the key segments or strata – perhaps age groups for customers of a health club. This would ensure that your systematic random sample selects proportionate numbers of customers from each age group. In most business-to-business markets however, a representative sample requires customers to be included in proportion to their value. To achieve this your customer list must first be sorted in order of account value, then be divided into strata, e.g. large, medium and small accounts. You can then apply a

different sampling fraction to each segment, as illustrated in Figure 1. If your top 40 customers account for 40% of sales they should be 40% of the sample. Perhaps a further 160 customers in the medium segment account for another 40% of sales, so should also account for 40% of the sample. 400 small customers might then account for the remaining 20% of sales and of your sample. Assuming a sample size of 200, this would involve 80 respondents from large customers (i.e. 2 from each account), 80 respondents from medium sized accounts (i.e. a sampling fraction of 1 in 2) and 40 respondents from small customers (i.e. 1 in 10). Customers in the medium and small segments would be randomly selected making the outcome representative of your business and unbiased.

Stratified random sampling				
Value segment	**% of turnover**	**% of sample**	**No of customers**	**Sample fraction**
High	40%	40%	40	2:1
Medium	40%	40%	160	1:2
Low	20%	20%	400	1:10

Figure 1: Example of a stratified random sample

The principle of sampling being representative of customer value applies mainly in business-to-business markets where the relative differences in customer value can be extremely large. In many markets, some customers would spend more than others but the differences would not be considered sufficiently large to make customer value a key segmentation variable. Other customer segments may distinguish between customer types more effectively. Perhaps age, gender, geographical location, or type of product purchased. Clearly, whatever the segmentation variable, the same sampling principle applies. If 24% of your customers are in Scotland, 24% of your sample should be Scottish.

3. Sample individuals as well as companies

You now have a reliable sample of companies, but in business markets it is individuals and not organisations that will take part in your survey. For accurate results, those individuals must also be a representative and random sample. If you simply include your 'main contact' at each company you will end up with a sample biased in favour of the individuals with whom you have most contact, and they may be more favourably disposed towards you. You should therefore compile for each company a complete list of all the people who deal with you and are influential in determining the customer's level of satisfaction. For each company to be surveyed you should then randomly sample the required number of individual contacts from that list.

4. Robust samples size

For a reliable result, your sample needs to be random and representative, so the small circle in Figure 2 must contain the same segments in the same proportions as the large one. But how big should the small circle be?

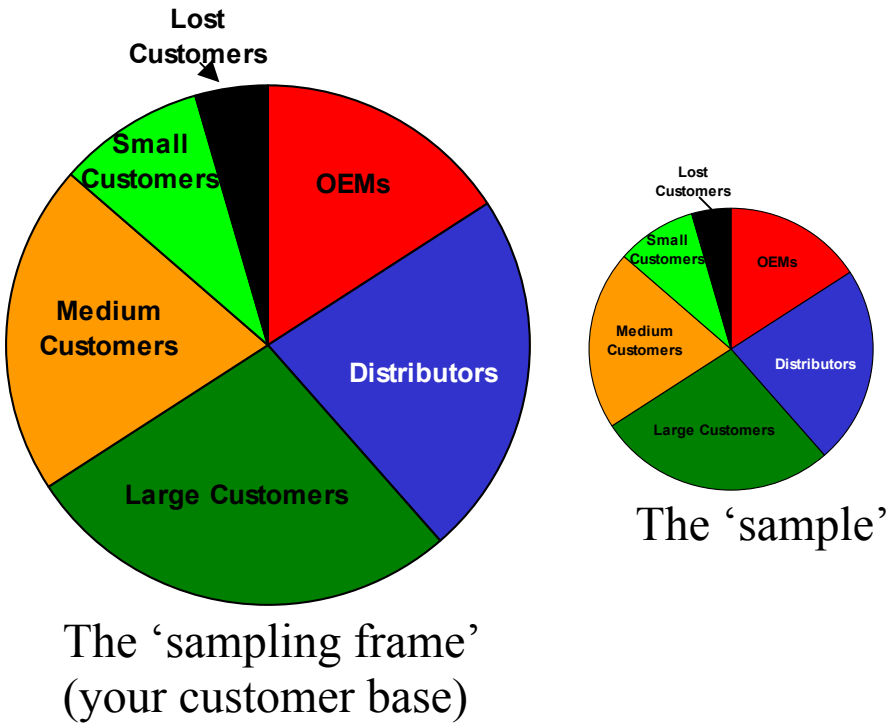

Figure 2: Sample and sampling frame

Statistically the accuracy of a sample is based on the absolute size of the sample regardless of how many people are in the original sampling frame. Asking what proportion of customers should be surveyed is not a relevant question. A larger sample will always be more reliable than a smaller sample. This is best demonstrated

by the normal distribution curve (see Figure 3), which basically tells us that whenever we examine a set of data it tends to follow this normal distribution. It does not apply only to research data. We might, for example, be looking at the average rainfall in Manchester in June over the last 300 years. We might see that in some years there has been virtually no rainfall in June (even in Manchester), for a few years there has been an incredibly high rainfall, but for most years the rainfall in June falls somewhere between those extremes in the 'normal' zone. Whether we are looking at data from a research survey or rain in Manchester, the key question is: 'What is the risk of abnormal data skewing the overall result?' The smaller the sample, the greater the risk.

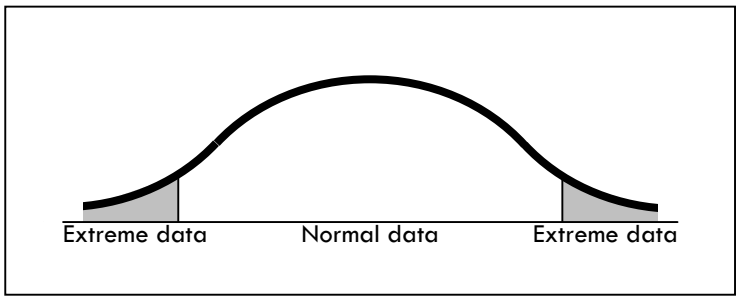

Figure 3: Normal distribution curve

If you recorded the rainfall in June in Manchester over a five year period when three of the years experienced normal June rainfall but two had exceptionally wet Junes, the average rainfall calculation would be heavily skewed by the two unseasonably wet months. If the data had been collected over 100 years, two exceptionally wet or dry months would make little impact on the overall result for the average rainfall in June in Manchester. The principle is the same with surveys. If you survey only 10 people and two of them happen to hold extreme views they would skew the overall result very heavily. They would make much less impact on a sample of 50 and virtually no

impact on a sample of 500, so the larger the sample the lower the risk of getting a rogue result. Figure 4 shows that as the sample size increases, so does its reliability. At first, with very small sample sizes the reliability increases very steeply, but as the sample size grows there are diminishing returns in terms of reliability from any further increases in sample size. You can see that the curve starts to flatten around 50 respondents, and this is typically said to be the threshold between qualitative and quantitative studies. By the time the sample size has reached 200, the gains in reliability from increasing the number of respondents in the sample are very small. Consequently, a 200 responses is widely considered to be the minimum advisable sample size. Companies with a very small customer base (around or below 200 contacts) should simply carry out a census survey.

Figure 4: Sample size and reliability

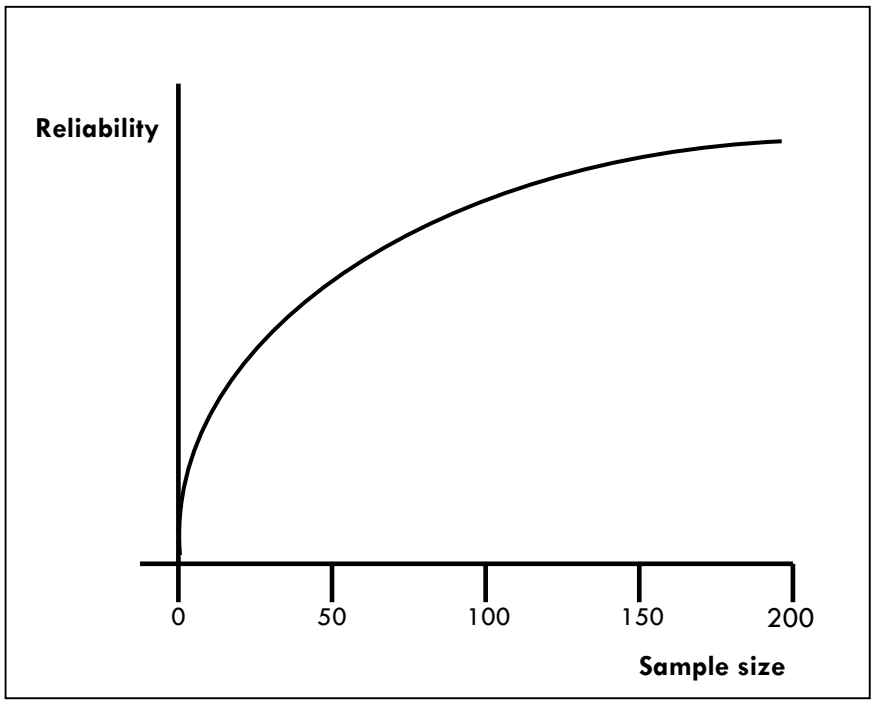

Figure 4: Sample size and reliability

Since a lower level of statistical reliability is normally acceptable for segment results, a minimum sample size of 50 in each segment would be regarded as adequate. Even so, if you have lots of segments, your sample size would be the number of segments multiplied by at least 50 responses. If a retailer has 90 outlets and wants to compare the relative performance of those outlets in satisfying their customers, it would need a minimum sample of 4,500 in total. Of course, the reliability at store level would be much better if each store had 100 or, preferably, 200 responses.

Take-home points

(a) ISO 9000:2000 suggests that recognised statistical methods should be used to generate a reliable sample for customer measurements.

(b) Samples should always be randomly drawn to ensure an unbiased result.

(c) For most organisations, stratified random sampling will be the best way to generate a sample that is both unbiased and representative.

(d) Sampling should be based on a sampling frame comprising relevant individuals. In business this could involve more than one respondent (sometimes several) from large customers.

(e) 200 responses is the minimum number for a reliable measure of customer satisfaction at the overall level. This applies regardless of how many customers you have.

(f) If the results are to be broken down into segments, the minimum sample size per segment should be 50 respondents. In such cases the required sample size will be the number of segments multiplied by 50.