SAMPLING

Sampling is a process that enables information to be collected from a small number of individuals or organisations within a project or programme, and then used to draw conclusions about a wider population. There are many different sampling methods. Quantitative analysis tends to require large, random samples. Qualitative analysis usually relies more on smaller, purposefully chosen samples.

In some projects and programmes it is possible to collect data from all stakeholders. For example, if a project supports fifty farmers it should be possible to interview all of them. Or if a capacity development programme aims to support five CSOs then it is straightforward to include all of them in any data collection exercise.

But it is not always possible to collect data from everyone. Many projects and programmes aim to support very large numbers of stakeholders or organisations. In these cases it is not practical to collect data from every stakeholder or organisation as it would require too much time and expense. The answer is to use a sample instead. Sampling enables information to be collected from a relatively small number of individuals or organisations, and then used to draw conclusions about a wider population.

Sampling can sometimes be a complicated process, requiring a large amount of careful planning and expertise in statistics. However, at other times it may involve something as simple as selecting a few community groups to visit during a field trip. In either case, it is always important to thoroughly understand how results will be analysed, and how the analyses will be used, before a sample can be developed.

Within monitoring and evaluation (M&E), CSOs tend to use samples at four different stages:

- before a project or programme starts, in order to contribute to design and planning;
- at the start of a project or programme, in order to form a baseline;
- during a project or programme, in order to establish what has changed and make modifications if necessary; and
- at the end of a project or programme, or sometime after completion, in order to establish what has changed.

Sampling may be carried out within an individual project or programme. But sometimes sampling is carried out across a range of different projects or programmes, or even across different countries and sectors.

This paper uses some terms that may not be familiar to those new to sampling. These are summarised in the box opposite, and are explained in more detail later in the paper

Terms Used in Sampling

This paper uses the term **unit** to refer to the individuals, households, communities or organisations about which data is to be collected. In some circumstances units might also be policies, publications or events.

The target **population** means the entire group of units from which data could theoretically be collected.

The **sample frame** is a list of all the known units in the population.

The **sample** is a list of specific units from which data will be collected.

The **sample size** means the total number of units from which data will be collected and analysed.

In development literature the capital **'N'** is often used to denote the population and the lowercase **'n'** to denote the sample.

Quantitative and qualitative sampling

Before sampling is considered it is important to know whether the data collected will be used for quantitative or qualitative analyses.
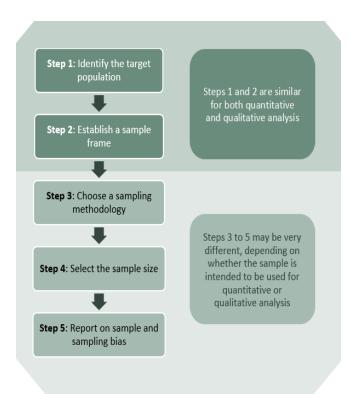
- The purpose of **quantitative** analysis is to produce findings that represent the wider population with a specific degree of precision. Samples generated for the purposes of quantitative analysis are often quite large, and are likely to be based on random selection.

- On the other hand, samples generated for **qualitative** analysis may be much smaller, and are often purposefully selected to provide the most revealing and useful data.

It is important not to confuse quantitative and qualitative sampling methodologies when choosing a sampling approach (Patton 1990). The rationale for collecting data, and the techniques used to generate the sample, are often quite different.

Key steps in sampling

The diagram on the following page shows five steps used to generate and use a sample. Steps 1 and 2 are similar for

both quantitative and qualitative inquiry, whereas steps 3, 4 & 5 are often very different.

The first step for both quantitative and qualitative sampling is to **identify the target population**. The target population means all the different units from which data could theoretically be collected. Depending on the purpose of the project or programme, units could be individual people, people of specific characteristics (such as women aged over sixty), households or communities. However, a project or programme may also target other entities such as organisations, policies, publications or events, and these are also valid units that can form a population. Some examples of populations are:

- all farmers owning land within 2km of a river in Southern Bangladesh;
- communities living within 10km of a town in Tanzania;
- health centres in an administrative district;
- events supported by a CSO over a two-year period; and
- partners receiving support from a capacity development provider.

In quantitative sampling, it is important to know – or be able to estimate – the approximate size of the target population. This is because the number is used to calculate the required sample size. Because of this, it is important to be as specific as possible about the target population. A good example would be *"all women of child-bearing age (defined as 15-35) in two districts, who attended a clinic in the last 12 months"*. For qualitative sampling this is not so important.

The next step is to **establish a sample frame**. A sample frame is a list of all the units in a population from which a sample can be selected. In some cases it is very easy to develop a sample frame. For instance, if the unit of analysis is organisations supported, campaigns run, or events organised, it should be easy to produce a comprehensive sample frame that covers the entire target population.

But sometimes the development of a sample frame is the most difficult part of sampling, especially if the sample is based around individuals or households living in a geographical location. For example, there may be no administrative records or population registers; or records might be out of date or incomplete. In these cases it is often necessary to make approximations.

It is also important to make sure that marginalised or vulnerable groups are included in the sample frame wherever possible (see box below).

Dealing with inclusion

Many projects and programmes run by CSOs are concerned with issues such as marginalisation and inclusivity. However, those excluded from official lists or records are often the most marginalised or vulnerable. Therefore, care is needed to consider whether any members of a population might be excluded from a sample frame. For example:

- a government register may exclude undocumented groups such as migrants or persecuted minorities;
- a map may be out of date and/or exclude temporary dwellings; or
- a list of email addresses may exclude those without an internet connection.

It is usually better to have a sample frame that includes individuals who are not in the defined population, than to have a sample frame that systematically excludes certain members of the population.

In cases, where no clear sample frame exists, various strategies for selecting individuals or households can be employed.

- *Random walks* are commonly used where there is no accurate register of households within a given area. As the name suggests, a random walk might involve moving through a village or community taking random turns, and then selecting houses using dice or any other form of random selection.

- *Snowball or chain sampling* is a common method used in qualitative studies, where a respondent is asked to suggest who else it might be appropriate to interview. This can be helpful when dealing with sensitive topics or engaging with a minority or rare population, who are hard to identify.

- *Convenience sampling* may also be used in the absence of a sample frame. Convenience sampling means choosing individuals based on ease of access,

e.g. because they happen to be around (maybe because they live near to an office, or the village lies next to a road) or because they are simple to contact. Convenience sampling can also mean interviewing those who volunteered to provide information. Convenience sampling is problematic because the responses of the group that provided information may differ considerably from the responses that would have been received from the parts of the population who did not provide information. This means any results from the sample may be biased in quite serious ways.

A common type of sampling that has emerged recently involves the use of web-based survey platforms (e.g. Survey Monkey). Because there is no cost to the researcher in surveying more individuals, online surveys are often sent out to an *entire population* (e.g. staff within an organisation) and then those that choose to respond may do so. If response rates are good (i.e. over 50 per cent), this can be a useful and cost-effective way of collecting data. However response rates are often very low, and in these cases the people who actually responded to the survey need to be treated as a convenience sample.

Designing quantitative samples

Steps 3-5 are very different according to whether quantitative or qualitative sampling is used. This section deals with steps 3-5 for quantitative sampling only. Qualitative sampling is dealt with in the next section.

STEP THREE — The third step in quantitative sampling is to **choose a sampling methodology**. Quantitative sampling is divided into two categories: probability sampling and non-probability sampling.

Probability and Non-probability Sampling

Probability (or random) sampling is used when there is a requirement to generalise findings across a target population, and quantify how likely it is that the findings generated from the sample represent the true value in the target population. This likelihood (or probability) is usually expressed as a *'margin of error'* or *'confidence interval'*.

Non-probability (or non-random) sampling is used when there is no requirement to say how likely it is that the findings from a sample are true for the entire target population. In non-probability sampling the margin of error is always unknown

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Some common probability-sampling approaches are listed below (see Bakewell et. al., 2003).

- *Simple random sampling:* A specified number of units are selected at random from the sample frame.

- *Stratified random sampling:* The overall sample frame is broken down into sub-groups according to factors such as gender, ethnic group or location. A random sample is then taken from each sub-group. This makes

it possible to ensure that each of the sub-groups is fully represented. For example, if 30% of households in the sample frame are headed by women, a stratified random sample would ensure that 30% of the sample would be taken from female-headed households. Stratified random sampling is used when information on different sub-groups is needed. It requires reliable information on the target population.

- *Cluster sampling:* Cluster sampling is often used when conducting face-to-face interviews. The geographical area covered by the target population is divided into clusters, such as villages or neighbourhoods. First a random sample of clusters is chosen, and then within each cluster a random sample of respondents is identified. Cluster sampling is mostly designed to reduce costs as it ensures that respondents are based in a limited number of areas. Cluster sampling is rarely used when surveys or interviews are conducted via telephone, or other forms of electronic media.

- *Multi-stage sampling:* This is similar to cluster sampling. It involves randomising at different stages. For example, if a project has many offices, each serving many communities then the first stage of random sampling could choose the offices, the second the communities and the third individual households within the communities.

Whilst quantitative analysis is normally based on probability sampling, non-probability sampling is often used instead because it is cheaper and quicker to administer than random sampling. *Quota sampling* is the most common form of non-probability sampling in quantitative analysis. This involves breaking a target population down into different sub-groups (e.g. men/women or different age groups) and then making sure that a certain number of units are interviewed or surveyed from each sub-group. The difference between quota sampling and stratified random sampling is that quota sampling does not involve choosing units at random. Instead, units are selected from the sample frame until the quota is fulfilled. Because quota sampling is not random, it is not possible to say how precisely the findings from the sample reflect the wider target population.

STEP FOUR — The fourth step is to **select the sample size**. A common misconception about sample sizes is that there is a standard or typical sample size that is acceptable. In fact, the required size of a sample very much depends on the purpose of data collection, the type of analysis to be conducted, and the questions that need to be answered through the sampling.

There are a few simple principles that apply when choosing sample sizes for quantitative analysis. Firstly, larger samples increase the precision of quantitative findings. Secondly, however, there are diminishing returns to increasing a sample size. Each extra unit in a sample has a smaller effect on the precision of the estimates than the last. Thirdly, the more diverse the target population, the larger the sample needs to be, to achieve the same precision.

INTRAC are regularly asked by organisations conducting surveys to recommend sample sizes for quantitative analysis. For non-probability sampling, because the precision of estimates is not quantifiable, the decision about sample size is usually a matter of judgement or convention.

For probability sampling it is possible to calculate the size of the sample required. In order to do this, depending on the purpose of the sample, the following parameters need to be known or estimated (see box below).

There are many sites online that can help produce these calculations, once the relevant parameters are known. However, most only cater for simple random samples. In fact, in anything other than simple random sampling, the calculations involved can be extremely difficult, and even experienced and trained researchers often struggle (Popplewell 2013). Furthermore, all the above parameters need to be assessed for each key variable measured through a sample, and calculations may need to be repeated for each variable. INTRAC's advice is that good sampling for quantitative analysis does require some statistical knowledge, and we would always recommend seeking external assistance to help calculate sample sizes if

the necessary expertise within an organisations does not exist.

In addition to the technical calculations, there are also many practical considerations to be considered when selecting the sample size for quantitative analysis. These include the size of budget to carry out the work, the time available, and the data collection methodology that will be used.

Ultimately, the sample size, which determines the precision of quantitative analysis, needs to be appropriate for the purpose of the data collection exercise. For example, an NGO doing a scoping study for a pilot education project in a new region might accept a relatively wide margin of error in estimating school attendance. This would require a relatively small survey sample. However, if the World Bank was implementing a results-based financing initiative where schools were rewarded for increasing attendance, the margins of error would need to be much smaller and the sample sizes larger.

STEP FIVE

The final step is to **report on sample and sampling bias**. Decisions over sampling always involve trade-offs between what is desirable from a methodological perspective and what is practical, and these decisions have many implications for the value of the data and analyses generated. So it is very important that the limitations of any data are stated and understood.

This means it is important to document the process of sampling so that people reading findings or analyses can understand them in context and challenge them if necessary. The documentation should at the very least include details on the target population, the sample frame, the sample size, the method used in sampling and any major challenges encountered.

Designing qualitative samples

Qualitative samples serve a very different purpose to quantitative samples. This section deals with steps 3-5 for qualitative sampling only.

STEP THREE

The third step in qualitative sampling is to **choose a sampling methodology**. There is little value in probability sampling for purely qualitative purposes. Most qualitative sampling uses non-probability sampling, where samples are selected based on one or more pre-determined characteristics. This is known as purposeful sampling. The aim is to sample strategically to include cases that can provide the most information-rich answers to specific questions.

There are many types of purposeful sampling techniques that generate different types of cases – far too many to mention in this paper. Some examples of purposeful sampling techniques include (see Roche (1999), adapted from Patton (1990)):

- best case sampling, used to explore the biggest or most important changes to which a project or programme has contributed;
- typical or representative case sampling, often used to understand typical effects of projects or programmes on people, communities or organisations;
- homogenous sampling, used to explore a number of cases covering a particular group or sub-group in-depth;
- criterion sampling, used to investigate cases that meet certain criteria, such as households headed by women, or girls attending secondary education;
- unusual, extreme, or deviant case sampling that can be useful in understanding cases which result in untypical results; and
- critical case sampling, which include cases that can make a point quite dramatically or are particularly important.

STEP FOUR

The fourth step is to **select the sample size**. There are no hard rules for determining sample sizes for qualitative inquiry. Most sample sizes are determined by judgement and experience. This is because purposeful sampling is designed to find the most information-rich cases that can help address key questions. For example, if a data collection exercise is designed to assess how marginalised people are treated within a community then it makes more sense to focus on examining in-depth the lives of carefully selected marginalised families than to gather standardised data from larger populations. The sample size therefore depends on the questions that need to be answered, the purpose of the inquiry, what information will be useful and credible, and practical issues such as the time and resources available to investigate the cases.

In general, the more units that are sampled, the greater the amount of data available. But as with quantitative sampling, there are diminishing returns to collecting additional data. One phrase often used in relation to qualitative inquiry is *'saturation'*. This is the point at which the same information keeps coming up over and over again. This is often a key part of sample size selection when using methods such as focus group discussions. The sample size is not fixed at the start of a data collection exercise. Instead focus groups continue to be organised until the same findings start to be repeated.

STEP FIVE

The final step in qualitative sampling is to **report on sample and sampling bias**. As with quantitative sampling, it is it is important to document the process of sampling. At the very least, details should be included on the target population, the sample frame, the sample size, the method used in sampling and any major challenges encountered.

However, an additional problem for qualitative analysis is that audiences do not always understand the purpose of qualitative sampling. As Patton (1990, p185) points out:

> *"The problem is ... that the utility and credibility of small purposeful samples are often judged based on the logic, purpose, and recommended sample sizes of probability sampling. What should happen is that purposeful samples be judged based on the purpose and rationale of each study and the sampling strategy used to achieve the study's purpose."*

In contrast to quantitative inquiry, the value of qualitative inquiry is far more likely to be a result of the information richness of the cases that are selected, together with the strengths and abilities of the researcher, than with the sampling approach or sample size.

Further reading and resources

The National Audit Office of the UK (see NAO under references) has produced a straightforward paper dealing with different kinds of quantitative sampling. This is available from the website: https://www.nao.org.uk/wp-content/uploads/2001/06/SamplingGuide.pdf

A paper by Michael Patton (1990) on purposeful sampling is also available from the internet and explains clearly the difference between purposeful sampling for qualitative inquiry and quantitative sampling methodologies. INTRAC has also produced a short paper on sampling called *"A Rough Guide to Sampling"* (see Popplewell 2013 below) that contains a bibliography on books and other resources for investigating sampling in more depth.

Further relevant papers in the M&E Universe deal with case studies and stories of change, surveys, quasi-experimental approaches and Randomised Control Trials. There are also papers on quantitative and qualitative analysis, which mention some of the sampling techniques mentioned in this paper.

▶ **Case studies and stories of change**

▶ **Surveys and questionnaires**

▶ **Quasi-experimental approaches**

▶ **Randomised Control Trials**

▶ **Quantitative analysis**

▶ **Qualitative analysis**

References

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