# 9 Quantitative Data Gathering Techniques

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The role of managers and researchers is concerned with analysing and solving problems. These problems come in many forms with common features and normally include some numerical information. Both managers and researchers need to understand a range of quantitative methods. In order to perform quantitative analyses, we need data. This chapter focuses on how to collect quantitative data: sampling and measurement issues, surveys and experimental research.

## The nature of quantitative research

Following the path of our Methods Map (see Chapter 4), quantitative methods are part of an **objective** ontology; and a **positivist** epistemology. Social science research has tended to be influenced by the hypothetico-deductive paradigm (a research approach that starts with a theory about how things work and derives testable hypotheses from it). Quantitative studies are defined as: quantifying the problem or research question and establishing the mechanisms through which one or more (quantitative) variable(s) may affect another variable. The following phrases are linked with a quantitative methodology and are used interchangeably: a deductive approach, an etic view, objective epistemology, a structured approach, systematic approach, numerically-based data collection, statistical analyses, and replicable research design. In other words, quantitative studies have four main characteristics: systematic/reconstructed logic and linear path (step-by-step straight line); hard data in nature (e.g. numbers); they rely on positivist principles, they have an emphasis on measuring variables and

testing hypotheses; finally, they usually verify or falsify a relationship or hypothesis we already have in mind. Advantages of using quantitative data relative to quantitative data include broad comparability of answers, speed of data collection, and the 'power of numbers'. Qualitative questions can be asked in a quantitative survey, but responses (and ensuing data) are much more structured (and some may say, restrictive).

The data that you need to collect will very much be driven by what research question you are trying to answer. This needs to be very specific, and will drive both your data collection *method*, and *sampling*. We discuss these below.

## Box 9.1: Examples of research questions suited for quantitative analysis

In its simplest form a quantitative research question will try to quantify the variables you wish to examine.

*e.g. What is the daily consumption of soft drinks of students at a particular Scottish University?*

*What is percentage of students in a particular Scottish University students consume soft drinks daily?*

Another researcher might wish to identify the differences between two or more groups on a single or multiple variables.

*e.g. What is the difference in the daily consumption of soft drinks between male and female students at a particular Scottish University?*

Finally, a researcher might wish to explore the relationship between one or more variables on one or more groups. This type of research is mostly associated with experiments and the identification of causal relationships as will be discussed later in the chapter.

*e.g. What is the relationship between weather and soft drink consumption for a particular Scottish University's students (or male and female students)?*

# Defining dependent and independent variables

Data analysis and design involves measuring variables which can be dependent or independent. We define dependent and independent variables as follows: dependent variable is what you as a researcher think will be affected by another variable (or by an experiment), while the independent variable(s) is what you think will affect the dependent variable. These will be identified directly from your research question. For example, if you are studying the effects of a new marketing program on customer satisfaction, the program is the independent variable and what aspect(s) of satisfaction are influenced or changed by the programme are the dependent variables. Other independent variables may include the age and gender of customers, the amount spent prior to the new marketing program, and other questions about their characteristics.

For all quantitative studies, a crucial component of design is selection and measurement of the dependent variable. It is crucial because the usefulness of the research depends upon the relevance of the dependent variable and its representation on the outcome of interest. Researchers must be cautious, as dependent variable selection reflects the problem definition process, and can thus influence the decision making. The above example suggests careful selection of which aspect of satisfaction to measure. Another example is if we were studying stress levels among office workers, and chose the dependent variable to be 'frequency of employee-to-employee disputes,' then the researcher would have to justify why such disputes are considered to be an appropriate indicator of stress rather than, for example, average number of absences throughout the group.



We briefly discuss experimental design here, as experiments can be seen as the 'purest' way to establish an association between two variables, and therefore score well on the concept of internal validity. We then extend the concepts to non-experimental (or survey-based) data.

## ■ Experiments

Experiments have wide applications in social science. Experiments are considered as very reliable, and an efficient means of data collection and verification or refuting theories. The study of causal links is the main purpose of experiments. In particular, researchers aim to identify if one change in an independent variable, caused by manipulation (of data), will affect a

dependent variable. The main difference between experiments and surveys is that researchers have increased control over the conditions and events of the experiment, as in many cases experiments are conducted in laboratories. Moreover, according to Oehlert (2000) experiments enable direct comparison between items of interest and can offer minimised comparison bias and error. The sampling unit of the experiment which provides measures based on experimental manipulation is referred to as the subject of the experiment.

## Experimental design process

Experimental design involves *four main design elements* (Zikmund, Babin, Carr, & Griffin, 2010). The first is *manipulation of the independent (experimental) variable*. Moreover, the way an independent variable is manipulated is defined as *experimental treatment.* This fact creates two groups. The *Experimental group* is the first and is represented by participants exposed to planned treatments. The second is called the *control group* and is represented by participants on which none of the planned treatments are made. It should be stated that the *control group* is therefore used to highlight the outcomes that occur among the *experimental group*. For example, if we were studying the stress levels among office workers in an environment where there is reduced daylight through blackened windows, then we would first need to run the study in an environment where there is a *normal* amount of daylight (a *control group*), so that it could be demonstrated that it was indeed the change in exposure to daylight that was the cause of increased disputes among workers in the *experimental group*, when the daylight exposure was reduced. The second step is selection and measurement of the dependent variable (discussed above, employee-to-employee disputes). The third step is selection and assignment of experimental subjects or test units while the fourth is control over extraneous variables (environmental variables affecting the dependent variable). Box 9.2 shows an example of a research that used experiments in order to address the research aim.