

Module 6

Quantitative Research Methods: Introduction

Quadrant 1

1. Introduction

Quantitative research methods are oriented towards the use of numerals and statistics in the analysis of data collected. This will enable the researcher to make statistically valid generalizations and inferences about the topic of study. This module describes the types of quantitative method and their advantages and shortcomings in application.

2. Learning Outcomes

By learning this module, a student will understand:

- the purpose of writing a quantitative research proposal
- the types of quantitative method
- the advantages and challenges of using quantitative methods and
- the research topics to which the use of quantitative research methods is most appropriate.

3. What is Quantitative Research?

Quantitative research involves the use of empirical methods to investigate a particular social and the phenomenon or research question, the data of which will be amenable to the use of numerical and statistical techniques in the analysis. The data that is collected is either numerical, or can be converted to numerical values. The data is analyzed through the use of relevant statistical techniques.

Quantitative researchers define in advance the particular topic they plan to study along with the current status in the existing research literature and the suitable methodology to study the same as well. Thus the study design is pre planned allowing only for such changes that may be required due to unforeseen circumstances. In many instances, the study will have a pre defined theoretical background to examine the new data to be collected from the field. This will enable the researcher to critically examine the evidences collected for his/her study in comparison to the available findings and make valid inferences and predictions about the different aspects of the topic studied. In this sense, the existing theory will be tested and validated providing for explanations about why and how a phenomenon occurs in a particular context. For example, with the help of the available theory, the researcher could explain why the sample he/she studied was feeling excluded from their social group they belonged to. This approach of making explanations about the topic studied based on the available theory is known as the deductive approach and this is the hallmark of the quantitative methodology.

Since quantitative methods focus on the use of numbers, they are ideal for answering certain types of questions. For example the following research questions can be studied quantitatively.

- What percentages of students among those who complete vocational training find gainful employment within a year of completing training?
- How many children among those who complete primary schooling enter secondary school?
- What is the difference in the levels of parental education, occupation and monthly income of the children attending the primary section of a municipal school and a private school in Mumbai?

The above questions are capable of collecting easily quantifiable responses as those are expressed in quantity or numbers.. However, sometimes we can also use quantitative methods to assess questions that

are not directly numerically oriented by converting their responses to numerals for the purpose of quantification in the analysis. For example, assume that we want to measure the attitudes of adolescent girls towards the practice of dowry, through the survey method. While preparing the attitude scale we can place the attitudinal statements and pre determine the respondents' answers to them in such a way that they are amenable to the use of numerical values and hence quantification.. The statement and the pattern of response in such an instance may appear as follows:

Statement: The dowry system is a social evil in India.(The respondent has to select the answer from the following set of response . Also assume that there are five statements and all of them have the same pattern of response scoring as given below).

1. Strongly Agree
2. Agree
3. Neither Agree or Disagree
4. Disagree
5. Strongly Disagree

The numerical values of 1-5 of the responses can be used to measure the overall attitudinal scores of respondents in the analysis. For example, the respondent's score on each statement will be summed up to get a cumulative score on the attitudinal scale. Similarly, we can also easily calculate the actual range of scores by multiplying the lowest and highest scores possible (in this example, 1 and 5) with the total number of statements in the scale. As we have five statements, the range will be between 5(1x5) and 25(5x5).We can even decide suitable class intervals based on this range to differentiate the degree of variation in attitudes. Continuing with the previous example, we can make three class intervals within the range of 5 to 25 such as the scores of 5 to 11 representing strong negative view about dowry, 12 to 18 representing moderately negative view about dowry and 19 to 25 representing strong positive view about the issue. After the analysis, it may be possible to say that 68 percent of the respondents had strong negative attitude towards the idea of practicing dowry, while 30 percent had moderately negative attitude; just two percent showed strongly favourable attitude towards dowry.

Quantitative researchers are careful about maintaining the objectivity of their research, and not allowing their own presence, behavior or biases to affect their research process. In claiming certain results, researchers will try to rule out any external influences that may have caused those results, and usually point out under what conditions those results hold true. For example, in the results from our previous example of adolescent girls' attitudes to dowry may only hold true to the girls from a particular school because the study may not have included a sample of girls from diverse geographical locations. Thus, the researchers cannot generalize or attribute these results to all adolescent girls in a particular district or state.

Quantitative research methods usually enable collecting data from large samples with predictable accuracy and in such instances the research results obtained can be generalized to even larger populations with similar characteristic features. Because it is generalizable, quantitative methods are often used to collect field data that can be used to design policies or interventions for large populations. For example, the National Family Health Survey can be used to design health policies and health interventions because a large amount of data is collected from representative populations across the country. Finally, because quantitative studies are defined and designed in advance, they can be more easily replicated in other conditions/areas to determine if the study results are applicable to the populations under study.

4. Key components of Quantitative Research Methods

As the next step to understanding quantitative research methods, we need to understand some of the key terms used in these methods.

- 1) Units: The people or things we collect research data on are called units, or research units. Some examples of units are human such as, children, tribal, working women, college students, workers in unorganized sector and so on and/or non human entities like schools, villages, houses, factories, colleges, NGOs, hospitals and so on.
- 2) Variables: Variables are the specific characteristics of the units that we are interested in researching. As suggested by its name, variables have values that vary. They vary in name, type, degree, number and so on. Some examples of variables are age, gender, educational level, income, type of occupation, level of awareness, level of participation and so on. We use research studies to demonstrate how two or more variables relate to each other. For example – we could measure how education levels of the respondents influence their income levels.

Variables are classified into different types depending on the purpose it serves in a given research study. Among those, the division into independent and dependent variables occupy a lot of importance. Independent variables are variables that influence or affect another variable. Dependent variables are variables that are affected by variations in the Independent variable. In our previous example of education levels and income levels, education level is the independent variable, while the income level is the dependent variable.

- 3) Sample: A sample is a subset of a total number of individuals/institutions/villages/towns/households/articles and so on from whom data is collected in a research study. In quantitative studies, data generated from a sample is used to make observations and inferences about the larger population.
- 4) Hypothesis: A hypothesis is a statement that explains the relationship between two or more variables, the validity of which needs to be tested with the help of empirical data.. This statement is tested during the research study. In quantitative research, a hypothesis is usually based on previous research findings. An example of a hypothesis is “The higher the educational level of the women, the higher their income level.”

You will have a chance to learn more about these components in future modules of this course.

5. Types of Quantitative Research

There are four primary types of quantitative research. It is important to understand the differences between these so that you can choose one that is most appropriate to your study.

- Descriptive

Descriptive research describes or quantifies identified variables. They typically seek to answer questions that describe certain phenomena. They sometimes involve questions such as “how much?” or “what percentage?” or “how often?” Descriptive research collects data on the status of things and uses this data to analyze the research question. Some examples of descriptive research questions are:

- What percentage of rag pickers are girls?
- How often do adolescents use social networks on a monthly basis?
- How frequently do children employed in home-based factories go to school each month?
- What is the extent of cigarette smoking among 18-25 year old Indians?

Descriptive research designs generally attempt to test variable relationships or causality between variables.

- Correlational

Correlational research attempts to determine to what extent two or more variables are related to each other. This type of study explores patterns and trends in the data, but may not be able to prove any causal links between the variables. Because of this, generally speaking, there is no manipulation of variables in this type of study— they are only studied in their existing states. Some examples of correlational research themes are:

- What is the relationship between volunteering and self-esteem?
- What is the relationship between smoking and age of the person?
What is the relationship between maternal education levels and family size?
- What is the relationship between malnutrition and family income levels?

Remember that in this type of study, although we can determine whether a relationship (positive or negative) exists between two or more variables, we cannot prove any causal connections. In order to do that, we would need to select a different type of study design.

- Cause-Comparative

Cause-comparative studies aim to establish a causal relationship between two or more variables. They are also known as quasi-experimental research designs. Although this type of study shares some similarities with Experimental research design, it is different because in this type of study, there is no randomized assignment of subjects in sample to control and experimental groups. Instead, researchers focus on comparing groups who have been exposed to certain treatments/interventions to other groups that have not had this exposure. Additionally, some quasi-experimental studies do not require the manipulation of the independent variable. By manipulation of a variable, we mean that a researcher change the value of the independent variable in a systematic way, in order to observe how these change effects a change in the dependent variable. Researchers undertaking this type of study have to be very careful in attributing causal relationships between variables because there may be external variables (which may or may not be evident to the researchers) which may be influencing the causal relationship. Some examples of cause-comparative research:

- The influence of preschool education on primary school completion
- The effect of smoking on lung cancer
- The effect of education levels on income
- The effect of poverty on mental health
- The effect of tutoring on the academic grades of children in Class 5.

Quasi-experimental designs are particularly useful in those cases where it is not practical or is unethical to conduct an Experimental research. However, quasi-experimental research studies are also subject to issues of internal validity because the control and experiment group (or pre intervention group and post intervention group, as they are sometimes known) may not have been exactly comparable or equal in their characteristics, and this may have influenced the study's results and the causal relationship between the variables.

- Experimental

Experimental research is often called “true experimentation” or the gold standard of empirical studies. In these types of studies, the independent variable is manipulated to assess causal relationships, and to determine that any variation in the dependent variable is actually caused by the identified variable, and not by some external variables. Another unique aspect of this type of study is that subjects are randomly assigned to control or experiment groups. At the start of the experiment, the identified subjects are as identical in their characteristics as possible, and then they are randomly assigned to a group that will receive a treatment or intervention (known as the experimental group) or to a group that does not receive a treatment or intervention (known as the control group). This strategy helps to limit or eliminate the

presence of any hidden or pre-existing characteristics (or variables) that may influence the study without the researchers' knowledge. Some examples of experimental research are as follows:

- The effect of classroom teaching and one-on-one teaching on children's academic grades
- The effect of "punishment free" education on children's self-esteem
- The effect of a new drug on HIV positive patients

Experimental research is challenging to conduct in field settings because of its requirements for equivalent subjects, and because the strict control required to rule out any external influences may be difficult to achieve outside of a laboratory. Further, results obtained in a laboratory setting may not be generalizable outside the laboratory. Nevertheless, experimental research is considered the gold standard precisely because it uses these conditions to rule out an outside influences on a causal relationship. This makes it possible to generalize the results of the study to the larger population with a high level of confidence. Thus, if a certain drug is found to benefit an experimental group of HIV positive patients, chances are that the drug may prove beneficial to populations who share the overall characteristics of the subjects in the sample. Because experimental research has the advantage of proving causality to an extent that other research designs cannot, social scientists are increasingly using this design to study causal relationships.

6. Tools to conduct Quantitative Research

Now that you have understood the different type of quantitative research designs, you may want to know more about the different tools that can be used to conduct quantitative research. The most common tool used in quantitative studies is surveys. Surveys can be conducted over the phone, online, through mail, in-person, or may be self-administered by participants.

Some researchers also use fixed panel studies or cohort studies. These types of studies focus on a certain cohort (or cohorts) over a particular period of time.

You will learn more about quantitative research tools in a future module of this program.

7. Advantages of Quantitative Research Methods

Based on this understanding of quantitative research, we now reflect on what are some of the advantages of this approach:

1. The greatest advantage of this type of research is its ability to produce quantitative, precise data.
2. Quantitative studies can produce defined results and can even specify the degree of certainty or probability of its results.
3. Quantitative studies are designed and implemented using scientific methods. This results in data that is reliable and accurate since it minimizes research biases.
4. Quantitative research produces data that can be generalized to a larger population – this is especially useful when designing policies or program interventions.
5. Quantitative analysis permits the testing of various hypotheses to verify if they hold true in a certain context.
6. Quantitative studies are designed and implemented using scientific methods. This results in data that is reliable and accurate since it minimizes research biases.
7. Quantitative research can be replicated in other contexts or time periods, and this facilitates a better understanding of a phenomenon in different contexts.

8. Quantitative Research uses various statistical techniques, including the tests of significance, correlation, and variance and so on. Since the methods of calculating these are exactly the same world over, it permits the comparison of results in cross-cultural studies.
9. Data analysis can be easily done using statistical software, and hence is less time-consuming.
10. Quantitative research methods make it simple to collect data from large samples in relatively short time durations.
11. Due to the accuracy and generalizable data produced, quantitative research methods are preferred by policy makers, funders and donors.

8. Limitations of Quantitative Research Methods

All research methods have their inherent limitations and it is important to understand these in advance so that you can make the best decision on what method/approach works best for your study. While quantitative methods have significant advantages, they also have certain limitations.

1. One disadvantage is that because of its numerical focus, quantitative research does not provide any contextual insights. It may thus ignore certain factors that influence subjects to think or act in a particular way.
2. Quantitative research may not allow for subjects to provide explanations or narrative data, which might imply an incomplete picture.
3. Quantitative research tools are sometimes designed in fixed ways – for example, closed-end surveys. Since these response options are decided by the researcher, the tool and data collected may often reflect the biases of the researchers.
4. Quantitative studies may be conducted in artificial or laboratory settings to maintain strict control of the process. This may imply that replicating these studies in the real life context may either not be possible, or may not yield similar results.
5. Because quantitative studies require some special conditions, they may prove to be expensive. For example, experimental studies require the identification of equivalent subjects, and this may be challenging and expensive.

9. When should we use Quantitative Research Methods?

By this point, you have understood the basics of quantitative research methods, including the types, advantages and limitations of these types of research methods. Making the correct choice of research methods is an integral part of the research design process. Therefore, we now consider in what situations quantitative research methods are the appropriate choice.

1. Quantitative research provides definitive and accurate numerical answers. Therefore, if your study requires numerical data, quantitative methods might be the right choice for your project.
2. Since quantitative data is easily replicable across different settings, if you need to obtain information from different contexts, these methods may be the right choice.
3. If you have certain hypotheses you want to test (for example: ensuring children complete schooling will mean they earn higher incomes as adults) or if you want to check the relationships between two or more variables (for example: smoking and lung cancer), then your study may benefit from the use of quantitative methods.
4. Quantitative data is generalizable to large populations. Therefore, if your research study is going to be used to design policies or interventions for a large group of people, then quantitative studies may be the right choice for your project.

Situations where you need to explore the personal life experiences of an individual, quantitative methodology may not be appropriate. Similarly when one wants to document a community process/ a group discussion/ the collective experiences of a social group and so on survey may not be very useful.

Further, because quantitative methods require a careful consideration of samples in order to be valid research, you may need to take into account budgetary considerations while planning your research study.

Quantitative research methods are therefore very useful when you are need data that is numerical, or results that can be generalized to larger populations.

10. Summary

- Quantitative research methods are oriented towards the collection (or conversion) of data in a numerical form.
- Statistical tests are used to analyze the collected data to explain certain phenomena.
- Key components of quantitative research methods are:
 - Units
 - Variables
 - Hypothesis
 - Sample
- There are four types of quantitative research:
 - Descriptive
 - Correlational
 - Cause-comparative
 - Experimental
- Surveys are the primary tool for quantitative research.
- Advantages: The key advantage of quantitative research is that it can be used to collect numerical data from large samples of populations. This data can then be generalized to larger populations.
- Disadvantage: A key disadvantage is that the quantitative research tools are fairly rigid and cannot be used to explore in-depth attitudes or perceptions.