

## QUANTITATIVE TECHNIQUES - AN APPLIED PERSPECTIVE

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### ABSTRACT

*Quantification brings precision and mathematisation leads to simplification. The main purpose of this paper is to introduce some important fundamental concepts of quantitative research to readers especially novice researchers. The main focus is on the assumptions underlying the quantitative research and some of the misconceptions that many researchers have when they are conducting a research study. It comprises types of research, definitions of quantitative research, different types and assumptions of quantitative research, when to use and not to use quantitative methods, advantages, common approaches and samples of quantitative research, and common misconceptions.*

**Keywords:** co relational, futuristic, exploratory, omnibus survey, ethnographic methods

### INTRODUCTION

#### Definition and Types of Research

Research has been defined in a number of different ways.

A broad definition of research is given by Martyn Shuttleworth - "In the broadest sense of the word, the definition of research includes any gathering of data, information and facts for the advancement of knowledge."

Another definition of research is given by Creswell who states - "Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question.

The Merriam-Webster Online Dictionary defines research in more detail as "a studious inquiry or examination; especially : investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws".

#### Steps in conducting research

The major steps in conducting research are:

- Identification of research problem
- Literature review
- Specifying the purpose of research

- Determine specific research questions or hypotheses
- Data collection
- Analyzing and interpreting the data
- Reporting and evaluating research

The steps generally represent the overall process; however they should be viewed as an ever-changing process rather than a fixed set of steps. Most researches begin with a general statement of the problem, or rather, the purpose for engaging in the study. The literature review identifies flaws or holes in previous research which provides justification for the study. Often, a literature review is conducted in a given subject area before a research question is identified. A gap in the current literature, as identified by a researcher, then engenders a research question. The research question may be parallel to the hypothesis. The hypothesis is the supposition to be tested. The researcher collects data to test the hypothesis. The researcher then analyzes and interprets the data via a variety of statistical methods, engaging in what is known as Empirical research. The results of the data analysis in confirming or failing to reject the Null hypothesis are then reported and evaluated. At the end the researcher may discuss avenues for further research.

Generally speaking, research can be classified into 3 main groups based on the application of the research study, its objectives in undertaking the research and how the information is sought:

On the basis of applications we have: (1) Pure research and (2) Applied research

On the basis of objectives, we have: (1) Descriptive research, (2) Exploratory research,(3) Correlational research ,and (4) Explanatory research

Depending upon the types of information sought, we have (1) Quantitative research and (2) Qualitative research

Depending upon the time of data collection, we have (1) Historical Research, (2) Present research and (3) Futuristic research

Each group can be further subdivided into many types. The main focus of this paper is Quantitative Research.

### **Quantitative Research defined**

Quantitative research is defined as social research that employs empirical methods and empirical statements-Cohen (1980). He states that an empirical statement is defined as a descriptive statement about what “is” the case in the “real world” rather than what “ought” to be the case. Typically, empirical statements are expressed in numerical terms; another factor in quantitative research is that empirical evaluations are applied. Empirical evaluations are defined as a form that seeks to determine the degree to which a specific program or policy empirically fulfills or does not fulfill a particular standard or norm.

Moreover, Creswell (1994) has given a very concise definition of quantitative research as a type of research that is `explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (in particular statistics).

A careful look at the definition above gives the impression that only numerical data should be collected for quantitative research. We are far less limited than what might appear above.

Many data that do not naturally appear in quantitative form can be collected in a quantitative way. We do this by designing research instruments aimed specifically at converting phenomena that don't naturally exist in quantitative form into quantitative data, which we can analyze statistically. Examples of this are attitudes and beliefs. We might want to collect data on employees' attitudes towards their organisations and their managers. These attitudes obviously do not naturally exist in quantitative form. However, we can develop a questionnaire that asks employees to rate a number of statements (for example, 'I think the company's internal culture is demotivating') as either agree strongly, agree, disagree or disagree strongly, and give the answers a number (e.g. 1 for disagree strongly, 4 for agree strongly). Now we have quantitative data on employee attitudes towards their company. In the same way, we can collect data on a wide number of phenomena, and make them quantitative through data collection instruments like questionnaires or tests.

### **Different Types of Quantitative Research**

There are several types of quantitative research. For instance, it can be classified as 1) survey research, 2) correlational research, 3) experimental research and 4) causal-comparative research. Each type has its own typical characteristics. Let's take survey research as an example:

Survey research uses scientific sampling and questionnaire design to measure characteristics of the population with statistical precision. It seeks to provide answers to such questions as "How many people feel a certain way?" and "How often do they do a certain behaviour?" Survey research enables management to make comparisons between groups. It provides estimates from a sample that can be related to the entire population with a degree of certainty (e.g., 69% of the population +/- 3% will answer the question this way 95% of the time). Survey research requires that respondents are "randomly" sampled - that means that each person in the population has a known probability of being sampled. There are defined techniques, such as random digit dialing and sampling procedures to ensure a scientific sample. In developing a survey, you would normally work with a statistician to build a statistically valid sampling plan, a researcher to develop a survey instrument and research objectives, and a reputable field service that has the capacity to conduct large scale interview projects. It is important to work with experts because the quality of the survey can be affected by the research instrument.

### **Assumptions: Realism, Subjectivism and the 'Paradigm Wars'**

As we have defined quantitative research, let's compare it with qualitative research, against which it is usually contrasted. While quantitative research is based on numerical data analyzed statistically, qualitative research uses non-numerical data. Qualitative research is actually an umbrella term encompassing a wide range of methods, such as interviews, case studies, ethnographic research and discourse analysis, to name just a few.

The difference between quantitative and qualitative research is often seen as quite fundamental, leading people to talk about 'paradigm wars' in which quantitative and qualitative research are seen as belligerent and incompatible factions. Many researchers define themselves as either quantitative or qualitative. Where does this idea come from?

This idea is linked to what is seen as the different underlying philosophies and worldviews of researchers in the two 'paradigms' (also called 'epistemologies' or sometimes 'assumptions'). According to this view, two fundamentally different worldviews underlie quantitative and

qualitative research. The quantitative view is described as being 'realist' or sometimes 'positivist', while the worldview underlying qualitative research is viewed as being 'subjectivist'.

What does this mean? Realists take the view that what research does is to uncover an existing reality. 'The truth is out there' and it is the job of the researcher to use objective research methods to uncover that truth. This means that the researcher needs to be as detached from the research as possible, and use methods that maximize objectivity and minimize the involvement of the researcher in the research. This is best done using methods taken largely from the natural sciences and then transposed to social sciences. Positivism is the most extreme form of this worldview. According to positivism, the world works according to fixed laws of cause and effect.

However, the view that there is a true reality that we can measure completely objectively is problematic. We are all part of the world we are observing, and cannot completely detach ourselves from what we are researching. Historical research has shown that what is studied and what findings are produced are influenced by the beliefs of the people doing the research and the political/social climate prevailing at the time of conducting the research.

If one looks at research from a quantitative versus qualitative perspective, qualitative researchers are subjectivists. In contrast to the realist view that the truth is out there and can be objectively measured and found through research, subjectivists point to the role of human subjectivity in the process of research. Reality is not 'out there' to be objectively and dispassionately observed by us, but is at least in part constructed by us and by our observations. There is no pre-existing objective reality that can be observed. The process of our observing reality changes and transforms it, and; therefore, subjectivists are relativistic. All truth can only be relative and is never definitive as the positivists claim.

If you look at the extreme forms of the two views we have set out here, it would seem that quantitative and qualitative research methods are pretty incompatible. These extremes are, however, a gross simplification of the views of both quantitative and qualitative researchers, and very few people in either 'camp' subscribe to them. A qualitative method is an umbrella term for a large number of different research methods (such as participant observation, interviews, case studies, ethnographic research) which are quite different. They are used by researchers with quite different worldviews, some of which clearly lie towards the realistic end of the spectrum. To ascribe radical subjectivist views to all qualitative researchers is a fallacy.

To label all quantitative researchers positivists is equally inaccurate. Quantitative researchers have taken up many criticisms of positivist views, and there are now a variety of epistemologies underlying theory and practice in quantitative research. It is true now to say that very few quantitative researchers nowadays are radical positivists.

### **Post-positivism, Experiential Realism and Pragmatism**

Post-positivists accept the critique of traditional positivism that has been presented by the subjectivists, without going so far as to reject any notion of realism. Post-positivists accept that we cannot observe the world we are part of as totally objective and disinterested outsiders, and accept that the natural sciences do not provide the model for all social research. However, they do believe in the possibility of an objective reality. While we will never be able to totally uncover that reality through our research, post-positivists believe that

we should try and approximate that reality as best we can, while realizing that our own subjectivity is shaping that reality. Rather than finding the truth, the post-positivist will try and represent reality as best he or she can.

In contrast to positivists, post-positivists believe that research can never be certain. Rather than focusing on certainty and absolute truth, post-positivist social science focuses on confidence - how much can we rely on our findings? how well do they predict certain outcomes?

A second worldview or epistemology that underlies the work of some quantitative researchers is called experiential realism. Experiential realists claim, as do anti-positivists, that we cannot observe the world in a purely objective way, because our perception itself influences what we see and measure. In contrast to subjectivist positions, however, experiential realists believe that there is a limit to subjectivity. Humans are limited in their subjectivity by

the fact that we use a limited number of schemas to formulate our views of the world. This is because our perception is 'embodied'. We don't observe passively, but actively interact with the world through our bodies.

Experiential realists see the use of metaphors as crucial to the way we make sense of the world around us. We use metaphors to understand our world. One of the main metaphors we use to do this is the subject/object schema, which divides the world up into objects (things) and subjects (people). This metaphor has its origins in the fact that in our dealings with the world we find that there is a distinction between an external world consisting of edges, surfaces and textures that are not us, and those things that are us, the actor. As we move around our world, the objects remain invariant.

A lot of researchers, both quantitative and qualitative, take a pragmatist approach to research, using different methods depending on the research question they are trying to answer. In some cases, this will lead them to quantitative research, for example when they need to give a quantitative answer to a question or generalize findings to a population, or are looking to test a theory mathematically; in other cases, they will employ qualitative methods. Sometimes a mixed method approach combining quantitative and qualitative methods will be the most appropriate.

### **When Do We Use Quantitative Methods?**

If we take a pragmatic approach to research methods, first of all we need to find out what kinds of questions are best answered using quantitative as opposed to qualitative methods.

There are six main types of research questions that quantitative research is particularly suited to find an answer to:

1. The first is when we want a quantitative answer. For example, 'If the employees have their choice, how many of them choose to undergo Training Program A? The reason why we need to use quantitative research to answer this kind of question is obvious. Qualitative, non-numerical methods will obviously not provide us with the numerical answer we want.
2. Numerical change can likewise only accurately be studied using quantitative methods. For example, 'Is the market share of our company rising or falling?' or 'Are sales of a particular brand going up or

down?’ We would need to do a quantitative study to find out the answer.

3. Quantitative research is useful for conducting audience segmentation. It is done by dividing the population into groups whose members are similar to each other and distinct from other groups. Quantitative research is used to estimate the size of an audience segment as a follow-up step to a qualitative study to quantify results obtained in a qualitative study and to verify data obtained from qualitative study.

4. Quantitative research is also useful to quantify opinions, attitudes and behaviours and find out how the whole population feels about a certain issue. For example, when we want to find out the exact number of people who think a certain way, to set baselines (e.g., to measure consumer attitudes regarding an ad prior to a campaign), and to ensure that the employees can share some comments or ideas to a compensation plan.

5. Quantitative research is suitable to explain some phenomena. For instance, ‘What factors predict the general communication proficiency of sales people?’ This kind of question can be studied successfully using quantitative methods, and many statistical techniques have been developed to make us predict scores on one factor or variable (e.g. employee communication proficiency) from scores on one or more other factors or variables (e.g. learning habits, motivation, attitude).

6. The final activity for which quantitative research is especially suited is the testing of hypotheses. We might want to explain something, for example whether there is a relationship between employees’ performance and their self-esteem and social background.

The types of problem or research outlined in 1 to 4 are called 'descriptive research' because we are only trying to describe a situation while those in 5 and 6 are called 'inferential research' because we are trying to explain something rather than just describe it. The former uses descriptive statistics whereas the latter uses inferential statistics. However, the ultimate goal of any quantitative research is to generalize the “truth” found in the samples to the population (while the ultimate goal of any qualitative research is to understand a certain phenomenon.)

### **When Shouldn't We Use Quantitative Methods?**

As mentioned above, while quantitative methods are good at answering these four types of questions, there are other types of questions that are not well suited to quantitative methods:

1. The first situation where quantitative research will fail is when we want to explore a problem in depth. Quantitative research is good at providing information in breadth from a large number of units. But when we want to explore a problem or concept in depth, quantitative methods are too shallow. To get really under the skin of a phenomenon, we need to go for ethnographic methods, interviews, in-depth case studies and other qualitative techniques.

2. As mentioned earlier, quantitative research is well-suited for the testing of theories and hypotheses. What quantitative methods cannot do very well is to develop hypotheses and theories. The hypotheses to be tested may come from a review of the literature or theory, but can also be developed using exploratory qualitative research.

3. If issues to be studied are particularly complex, an in-depth qualitative study (a case study, for example) is more likely to pick up on this than a quantitative study. This is partly because there is a limit to how many variables can be looked at in any one quantitative study, and

partly because in quantitative research it is the researcher who defines the variables to be studied. In qualitative research unexpected variables may emerge.

4. Finally, while quantitative methods are better at looking at cause and effect (causality, as it is known), qualitative methods are more suited to looking at the meaning of particular events or circumstances.

What then do we do if we want to look at both breadth and depth, or at both causality and meaning? In these situations, it is best to use a so-called a mixed method design in which we use both quantitative (for example, a questionnaire) and qualitative (for example, a number of case studies) methods. Mixed method research is a flexible approach where the research design is determined by what we want to find out rather than by any predetermined epistemological position. In mixed method research, qualitative or quantitative components can predominate or both can have equal status.

### **Units and Variables**

When conducting quantitative research, a researcher should have a clear understanding about the concepts of 'research units and variables'. When we collect data for quantitative research, we have to collect them from someone or something. The people or things (e.g. companies) we collect data on or from are known as research units, units or cases. If we have to draw the data from the samples of population, the samples are also called sampling units. They all are the same. We can generalize the findings of our research study to the population from which we draw its sampling units.

The data that we collect from these units are known as variables. Variables are any characteristic of the unit we are interested in and want to collect (e.g. sex, age, self-esteem).

The name variable refers to the fact that this data will differ between units. For example, performance will differ between employees and companies; gender will differ between employees, and so on. If there are no differences at all between units we want to study we probably aren't going to be able to do any interesting research. For example, studying whether employees are human would not yield interesting findings.

### **What is a Hypothesis?**

A hypothesis is a tentative explanation that accounts for a set of facts and can be tested by further investigation. For example, one hypothesis we might want to test could be that poverty causes low English achievement, or that there is a relationship between students' self-esteem and the amount of time they spend watching television. Quantitative researchers will design studies that allow us to test these hypotheses. We can collect the relevant data and use statistical techniques to decide whether or not to reject or provisionally accept the hypothesis. Accepting a hypothesis is always provisional since new data may cause it to be rejected later on.

### **Advantages of Quantitative Research**

1. Provides estimates of populations at large.
2. Indicates the extensiveness of attitudes held by people.
3. Provides results which can be condensed to statistics.
4. Allows for statistical comparison between various groups.

5. Has precision, is definitive and standardized.
6. Measures level of occurrence, actions, trends, etc.
7. Can answer such questions as "How many?" and "How often?"

### **Common Approaches to Quantitative Research**

1. Surveys
2. Custom surveys
3. Mail/e-mail/Internet surveys
4. Telephone surveys
5. Self-administered questionnaire surveys
6. Omnibus surveys
7. Co relational research
8. Trend analysis
9. Exploratory research
10. Descriptive research
11. Experimental research

### **Samples of Quantitative Research: Survey Research**

Among many types of quantitative research mentioned above, survey research is very popular and it has many types. Survey Research is the systematic gathering of information from respondents for the purpose of understanding and/or predicting some aspects of the behavior of the population of interest. The survey research is concerned with sampling, questionnaire design, questionnaire administration and data analysis.

#### **Types of Surveys**

**In-person Interviews:** Here the researcher meets the respondents face to face to collect their responses.

**Telephone Interviews:** Here the interviews are conducted over telephone

**Omnibus Survey:** An omnibus survey is a method of quantitative marketing research where data on a wide variety of subjects is collected during the same interview. Usually, multiple research clients will provide proprietary content for the survey (paying to 'get on the omnibus'), while sharing the common demographic data collected from each respondent. The advantages to the research client include cost savings (because the sampling and screening costs are shared across multiple clients) and timeliness (because omnibus samples are large and interviewing is ongoing). An omnibus survey generally uses a stratified sample and can be conducted either by mail, telephone, or Internet.

**Self-Administered Questionnaires:** The self-administered questionnaire is a questionnaire that a respondent completes on his/her own, either on paper or via computer.

**Central Location Intercept Interviews:** Central Location Intercept Interviews involve stationing interviewers at a point frequented by individuals from the target audience (e.g.,



shopping malls). Interviewers stop, or intercept, consumers and interview them using a survey method. Results of intercept interviews are not statistically projectable to the population from which participants are drawn. Like other qualitative research techniques, intercept interviews enable program managers to gain insights into the attitudes, beliefs, motives and behaviors of the target population. Intercept interviews employ a one-on-one interviewing method - a preferred method for assessing the communication value of materials. A typical central location intercept interview begins with the intercept. Potential respondents are stopped and asked whether they will participate. Then, specific screening questions are asked to see whether they fit the criteria of the target audience. If so, they are taken to the interviewing station (a quiet place), shown the pretest materials and asked questions. The questions included in the intercept protocol help assess comprehension of, individual reaction to and personal relevance of tested materials. The questionnaire used during intercept interviews is structured containing primarily close-ended questions. Open-ended questions are kept to a minimum.

### **Common Misconceptions**

There are many common misconceptions among novice researchers about how to conduct quantitative research, and here are some of them.

Do I have to have an epistemology to do research? No, not necessarily. While you may have strong epistemological and philosophical beliefs that determine what kind of research you want to do, you can also start out wanting to solve a particular problem or wanting to find out about a particular phenomenon. In such a situation you will be able to pragmatically choose those methods which are best suited to solve your research question.

Do data have to be in a quantitative format to do quantitative research? Not necessarily. If data are not naturally available as numbers, you can try and turn non-quantitative data (like attitudes or opinions) into quantitative data by measuring them numerically (for example, by using a Likert rating scale).

Are qualitative and quantitative research incompatible? Not necessarily. Qualitative and quantitative research can be usefully combined in mixed methods designs, which often produce a lot of useful information. Also, depending on your research question, you might, in one instance, want to use quantitative and, in another instance, qualitative research.

Is statistics the most important thing about quantitative? Not at all. While the way in which you analyze your data matters, if you haven't designed your research well and collected the data in a valid and reliable way, you will not get valid results however sophisticated your analyses.

Is qualitative research purely subjective? Not necessarily. While some qualitative researchers might take a strong subjectivist stance, there is a wide variety of qualitative methods that can accommodate a variety of viewpoints.

Can we explain things using quantitative research? To do that, do we need to use qualitative methods? That is not strictly true. While qualitative research usually provides more depth and less breadth than quantitative research, a well-designed quantitative study will allow us not just to look at what happens, but to provide an explanation of why it happens as well. The key lies in your research design and what variables you can collect.

**SUMMARY**

In this paper we have discussed what quantitative research is. Quantitative research is about explaining phenomena by collecting quantitative data which are analyzed using quantitative methods.

The fact that the data have to be quantitative does not mean that they have to be naturally available in quantitative form. Non-quantitative phenomena (such as customer attitudes) can be turned into quantitative data through our measurement instruments.

Quantitative research is often placed in opposition to qualitative research. This is often turned into a 'paradigm war' which is seen to result from apparently incompatible worldviews underlying the methods. When you look closely at researchers' actual beliefs, it appears that the so-called subjectivist (qualitative) versus realist (quantitative) divide is not that clear-cut.

Many researchers take a pragmatic approach to research and use quantitative methods when they are looking for breadth and they want to test a hypothesis or want to study something quantitative. If they are looking for depth and meaning, they will prefer to use qualitative methods. In many cases, mixed methods approaches will be appropriate

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