



Research Paper

SAMPLING - A PARADIGM FOR RESEARCH IN PHYSICAL SCIENCES

DR. MCCHESTER ODOH

Department of computer science Michael okpara university of agriculture, umudike, abia state Nigeria

ABSTRACT:- What we call research is argued by authorities as "not fact-finding", and such authorities further their argument that "when you don't know and you carry out investigation in order to know it is not research but fact finding". That research, is (only) a study designed to fill a gap in human knowledge (Awokeni, 2001) wherever this argument goes the fact remain that in management sciences whenever a problem exists and needed to be solved, a search and/or further search has to be conducted to gather knowledge in order to solve such problems. But since management problems are social problems, social research is essential and this entails studying a collection me objects individuals and events. Most times this collection of individuals for study are large that studying them would not make sense hence use of samples drawn from the collection.

I. INTRODUCTION

The paper therefore examines sampling as the most viable method of carrying out research in this area. Various descriptions (definition) of Panorle vis-a-vis population were x-rayed, we also looked at role of sample in research what an appropriate samples for a study should be: sampling methods and techniques that are available, what makes a good sample after the x-raying all available authorities work within the limit of available time, we found that though probability sample is most technically describable, many researchers in the social research adopt other methods in the non-probability approach.

We concluded that whatever the method, what is essential is that problem solving must be preceded by research and samples study rather than population. It is mostly cost default, but the method to adopt should be contingent to balancing the level of technical ability, the degree of precision desired and the time and cost associated with the desired result.

Man is a rational animal, and rationality is the fact that he uses his faculty to solve problems. A lot of problems man solves are done by the process of observation of phenomena experimenting on causes and effects and according to Awokeni (2001), by conducting research in which information is discovered, tested and validated" whether any of the processes of solving problems above is adopted, in many circumstances the objects or events of observation, experiment or research study may be large, cumbersome, expendable or unattainable that it may be difficult if not impossible to cover all individual "candidates" (Onwuchekwa, 1993) the collection of their objects, individuals or events that share a common characteristic for observation or investigation is what Unyimadu (2005) called population.

Most human problem that requires solving which invariably gives rise to investigative study rests in the population. And to get matters clear about population, Macodo (1997) described population as the entire group of measurement or observation that the investigation is concerned with. It is also the totality of unit, unit under study (Macodo, 1997). Though, some of their collection of all the elements of study being studied Waller 1999 could be small enough do investigation by a researcher, most times census study is very often rather an expensive affair, especially when the population is large; hence, most authorities advocate sample study

II. REVIEW OF RELATED LITERATURE

Sampling theory

On most cases we are interested in drawing conclusions about a large group of individuals or objects. Instead of studying the entire set called the population which in some instances may be very difficult, we may decide to study only a small part of this population which is called sample. This is observed by inferring certain facts about the population of interest from results obtained in the sample Ogam (2000) clearly states that a population n may be finite or infinite while the same size n , is generally finite, for instance, the number of females that took jamb examination in 2006/2007 jamb UME is a finite population. Alpo a study of girls that took 2006/2007 UTME is 5 selected schools in Enugu is a finite sample of the population.

In another example, the author once worked as an assistant in brewery where a bottle of beer is taken off the bottling line at an interval of five minutes for quality checks in terms of bottle wash cleanliness, CO₂ volume, pressure of bottles and leakage. The per hour number of bottles taken, off the line per hour, is 12-a finite (sample), but the number of bottles that pass the sampling point in which is not recorded and could somehow be regarded as infinite. (Source: authors reproof participation in a job involving sampling 1984)

Also an environmental scientist that takes 50 liters of water (finite sample) from a community source of water every week for testing may be collecting finite sample from an infinite population. The second example is typical of what Bordens and Abbotts (2001) called in this 3 type sampling technique as time sampling.

III. ROLE OF SAMPLE IN RESEARCH

Use of sample affords a researcher the ease and possibility of handling or managing the variables of interest in the study statistically so as to arrive at a definite and comprehensible conclusion with which he can make inference or generalization about the population. A great distortion would be introduced if all the variables of interest are studied in terms of the relationships existing between them, for large population (Cooper and Emory, 1995) this is because the manipulation of tools of statistics and mathematics may be incomprehensible by humans. Again "sampling possesses the possibility of better interviewing (testing). More thorough investigation of missing, wrong or suspicious information, better supervision and better processing than is possible with complete coverage (Cooper and Emory, 1995).

What is an appropriate sample size needed for a study?

There has been argument as to what sample size that is appropriate in any research study. A good sample is one that gives a fair representative of population (Macclayton, 2001). When sampling rules are followed, however, the researcher is assured of minimizing the chances of bias and misrepresentation (Wheelwright & Markridakis, 1985). However Cooper and Emory (1995) argued that "one false belief is that a sample must be large or it is not representative. View went further to argue that though it is often claimed that a sample should be some proportional relationship to the size of the population from which it is drawn, "how large a sample should be is a function of the variation in the population parameters under study and the estimate precision needed by the researcher'.

Furthering their argument, view stated that the basic formulae for calculating sample size in probability sampling assumes an infinite population; thus, a sample of 100 drawn from a population of 5000 has roughly the same estimating precision as 100 drawn from a population of 200million. That the most important factor determining the size of a sample needed for estimating a population parameter is the size of the population variance; the larger the sample must be to provide estimation precision (Cooper and Emory, 1995). This argument goes to state that the generally accepted practice of using Vemini's formula or fixed percentage of 10%, 20% etc. Without knowledge of variance or dispersion in the population is only accepted in the academic especially the management sciences as a matter of convenience and not necessarily reflecting the level of precision and researcher want to achieve. This is common in non-probability sampling.

IV. SAMPLING METHODS

In many situations data must be estimated from samples. Optimal sampling methods are fairly well developed in statistics but these methods have not been used extensively in the collection of most data (Wheelwright and Makridakis 1985).

Generally these numerous methods of sampling come under two classes.-probability sampling -non probability sampling

The different classes of sampling achieve making sure the samples are representative of the population. The difference between them is that the probability sampling, every element in the population has a known chance though not equal of being selected in the sample (Unyimadu, 2005).

V. PROBABILITY SAMPLE

The unrestricted, simple random sample is the simplest form probability sampling. All probability samples must provide a known non-zero chance of selection from each population element, and the simple random sample is considered a special case in which population has a known and equal chance of selection (Cooper and Emory, 1995) probabilistic sample is based on the concept of random selection in a controlled procedure that assures, that each population element is given a known non-zero chance of selection.

The sampling methods under the Probability sampling are

- Systematic sampling - in this approach every kth element in the population is sampled, beginning with a random start of an element in the range 1 to k. The major advantage of systematic sampling is its

simplicity and flexibility (Cooper and Emory, 1995). But it is proof to periodicity and monotonic trend problems which could give biased results.

- **Stratified Sampling:** most populations can be segregated into several mutually exclusive subpopulations or strata. The process by which the sample is constrained to include elements from each of segments is called stratified random sampling.
- **Cluster sampling:** in a random sample each population element is selected individually. The population can also be divided into groups of elements with some groups randomly selected for the study. This is cluster sampling (Cooper & Emory, 1995). When properly done, cluster sampling also provides an unbiased estimate of population parameters.
- **Simple random:** each population element has an equal chance of being selected into the sample. Sample is drawn using random number table/ generator such as computer. This is easy to implement, provided there is an automatic dialing or number generating system. But it has disadvantage that it requires a listing of population elements. It is expensive as it user large sample size (cooper & Emory, 1995).

NON-PROBABILITY SAMPLE

Probability sample clearly shows a technical superiority over non probability sample because a random selection of elements is done and this reduces or eliminates sampling bias. Non probability sampling uses subjective approach. It is subjective in that the probability of selecting population elements is unknown. But we may use non probability sampling because such a procedure satisfactorily meets the sampling objective. A second reason for choosing non probability sampling over probability sample is cost and kind of conducting probability. Also while probability sampling may be superior in theory, there are breakdown in its application. Even carefully stated random sampling procedure may be subjected to careless application by the people involved.

The commonest non probability sampling available are:

1. Convenience samples: here samples are unrestricted. The researchers or field workers have the freedom to choose whoever view can find. Thus the name convenience (Cooper & Emory, 1995). It is likened to what Unyimadu (2005) called accidental to sampling. Sample here has no control to ensure precision.
2. Purposive sampling: it selects individuals or objects on the basis of prior judgment about their relevance to the study (Unyimadu, 2005) this is a non-probability sampling that conforms to certain criteria, (Cooper & Emory, 1995)

Two major types of purposive samples can be identified

- Judgment Sampling
- Quota Sampling

Judgment sampling is appropriate for use (Cooper & Emory) in early stage of an exploratory study; and also good when one wishes to select a biased group for screening purposes.

Quota sampling is used to improve representativeness. The logic quota sampling is that certain relevant characteristics describe the dimension of the population.

One other method which cooper and Emory (1995) identified under non probability sampling is snowball sampling this is applied where respondents are difficult to identify and are best located through referral networks. Individuals are discovered and may or may not be selected through probability methods. This group is then used to locate others who possess similar characteristics and who, in turn identify others. They snowball gathers subjects as it rolls along.

SAMPLING TECHNIQUES

it may be more convenient or economical to collect some information by sample and then use this information as the basis for selecting sub sample for further study (cooper & Emory). This means that sampling can come in three techniques (waller, 1999).

Single sampling here there is only one sample level required, once the objects or individuals are identified and selected, it is accepted as sample.

Double - here information gathered on the first sub sample is used for further sampling. Here there are two limits of non-conformity.

Sequential or multiple sampling-this is usually found with stratified and / or cluster designs. It is usually a complex procedure with serious calculation.

What makes a good sample?

The ultimate test of a sample design is how well it represents the characteristics of the population it supports to represent in measurement terms the sample must be valid. Validity of a sample depends upon two conditions (Cooper & Emory, 1995).

Accuracy this is degree to which bias is absent from the sample. An accurate (unbiased) sample is one in which the underestimators and over estimators are balanced among the members of the sample.

Precision- A second criterion of a good sample designed in precision of estimate. Precision is measured by the standard error of estimate, a type of standard deviation measurement; the smaller the standard error of estimate the higher is the precision of the sample.

SUMMARY

Research must be conducted in order to give an informed decision in problem solving. Knowledge must be available for human decision, and it may not be acquired without research. Research may require studying a population but in the management sciences where time and cost and human behavior is very dynamic, the only possible way to conduct a quick research and yet be able to use our result to generalize is by using sample study. While the most technical probability sampling, should be the ultimate in order to assure better accuracy and higher degree of precision so that our inference should be as high as 95% degree of confidence, other methods could be used depending on the situation, provided care is taken to conduct a creditable and acceptable study.

DEFINITION OF COMMON TERMS

Social Research: A research where human beings are the objectives of study and human behavior constitute the variables of study.

Contingent: Used here as following the dictates that situation demand

Precision: the degree of expertness to the represented population usually measured by standard error of estimate.

Experimentation: a controlled cause and effect research

Survey: to question people and record their responses for analysis.

Candidates: all observable or investigable elements of a determined population.

Variable: a construct or the property being studied. Or a property or phenomenon capable of assuming different values.

REFERENCE

- [1]. Awokeni A.J (2001), "Research Method, In Business And Public Administration A Practical Approach" African Heritage Publication, Ikoyi, Lagos.
- [2]. Cooper D.K Emory C.W (2000), "Business Research Methods" 4th Ed. Burbidge Illinois.
- [3]. Keith, L.A & Gubeling, C.E (1975), 4th Ed. "Introduction to Business Enterprise" McGraw-Hill Kogakusha.
- [4]. Mac'odo D.S. :(199)"Quantitative and Statistical Analysis for Business Decision"-Winnett Paul. Port Harcourt.
- [5]. Macclayton W.D, (1998), "Research Methods" An Unpublished Lecture Material, RSUST, Port Harcourt.
- [6]. Ogam F.N (2000), "Foundation of Statistics and Probability", Springfield Publishers, Port Harcourt.
- [7]. Onwuchekwa. C.I (1993), "Management Theory and Organizational Analysis. A Contingency Theory Approach" Obio Enterprises, Enugu.
- [8]. Uyimadu S.O (2005), "Research Methods and Procedures in the Social Sciences Management Science, Education, Science and Engineering "Harmony Books, Benin City.
- [9]. Waller D.L (1999), "Operations Management A Supply Chain Approach. Thomson Business Press.
- [10]. Waller D.L (1999), "Operations Management A Supply Chain Approach" Thompson Business Press.
- [11]. Wheelwright S.C and Makridakis S. (1985), "Forecasting Methods for Management" 4th Edition, New York, - John Wiley and Sons. Wole Adewumi (1988)"Business Management. An Introduction" Macmillan. Nigeria