Chapter 3 – Research Methodology and Research Method

Chapter · March 2012

CITATIONS
69

READS
1,572,515

1 author:

Sam Goundar
Multiple Universities
168 PUBLICATIONS **703** CITATIONS

SEE PROFILE

Chapter 3 – Research Methodology and Research Method

This chapter looks at the various research methodologies and research methods that are commonly used by researchers in the field of information systems. The research methodology and research method used in this research is acknowledged and discussed.

The chapter starts off by providing a comprehensive introduction to research. Then the research methodologies and research methods particularly used in information systems are discussed. A significant effort has been made to clarify and provide distinctions between research methodology and research method. During the course of this research, when investigating the literature on research methodology and research methods, it was found that many researchers were using the two interchangeably. Therefore the two sections on research methodology and research methods have been treated separately.

A section that compares and differentiates between the two is presented first, followed by the section on research methodology. Then the different types of research methodology are described and the two main types of research methodologies namely qualitative research methodology and qualitative research methodology is discussed. The research methodology that has been utilised for this research is discussed and the reason why the particular research method was chosen with proper justification is explained.

Then research methods in general are discussed and the types of research methods suitable for information systems research are explained. The differences between the qualitative and quantitative research methods are elaborated upon. Since secondary data sources have been used in this research, a section is included to discuss the differences between the two and to explain the advantages of using secondary data sources for research.

Then the research method, that is, the actual data collection and data analysis method is described and justification is provided on why the particular research method was chosen. Case study research method is combined with grounded theory research method for document analysis of archival data that was accessed via the Internet. Descriptive methods have been used to investigate the opportunities and issues of cloud computing with mobile phones for developing countries.

3.1 Research Introduction

According to Rajasekar et. al. (2006), research is a logical and systematic search for new and useful information on a particular topic. It is an investigation of finding solutions to scientific and social problems through objective and systematic analysis. It is a search for knowledge, that is, a discovery of hidden truths. Here knowledge means information about matters. The information might be collected from different sources like experience, human beings, books, journals, nature, etc. A research can lead to new contributions to the existing knowledge. Only through research is it possible to make progress in a field. Research is done with the help of study, experiment, observation, analysis, comparison and reasoning. Research is in fact ubiquitous. More precisely, research seeks predictions of events and explanations, relationships and theories for them.

When you say that you are undertaking a research study to find answers to a question, you are implying that the process:

1. is being undertaken within a framework of a set of philosophies (research approaches);
2. uses procedures, methods and techniques that have been tested for their validity and reliability;
3. is designed to be unbiased and objective.

Philosophies mean approaches e.g. qualitative, quantitative and the academic discipline in which you have been trained.
Validity means that correct procedures have been applied to find answers to a question.
Reliability refers to the quality of a measurement procedure that provides repeatability and accuracy.
Unbiased and objective means that you have taken each step in an unbiased manner and drawn each conclusion to the best of your ability and without introducing your own vested interest. *(Bias is a deliberate attempt to either conceal or highlight something).*

Adherence to the three criteria mentioned above enables the process to be called ‘research’. However, the degree to which these criteria are expected to be fulfilled varies from discipline to discipline and so the meaning of ‘research’ differs from one academic discipline to another.
The difference between research and non-research activity is, in the way one finds answers: the process must *meet certain requirements to be called research.* One can identify these requirements by examining some definitions of research.

The word research is composed of two syllables, *re* and *search.*
re is a prefix meaning again, anew or over again
search is a verb meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun *describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles.*

Research is a *structured enquiry that utilizes acceptable scientific methodology to solve problems and create new knowledge that is generally applicable.*
Scientific methods consist of systematic observation, classification and interpretation of data.

Although we engage in such process in our daily life, the difference between our casual day- to-day generalisation and the conclusions usually recognized as scientific method lies in the degree of formality, rigorousness, verifiability and general validity of the latter.

Characteristics of Research:

Research is a process of collecting, analyzing and interpreting information to answer questions. But to qualify as research, the process must have certain characteristics: it must, as far as possible, be controlled, rigorous, systematic, valid and verifiable, empirical and critical.

- **Controlled** - in real life there are many factors that affect an outcome. The concept of control implies that, in exploring causality in relation to two variables (factors), you set up your study in a way that minimizes the effects of other factors affecting the relationship.

- **Rigorous** - you must be scrupulous in ensuring that the procedures followed to find answers to questions are *relevant, appropriate and justified.* Again, the degree of rigor varies markedly between the physical and social sciences and within the social sciences.

- **Systematic** - this implies that the procedure adopted to undertake an investigation follow a certain logical sequence. The different steps cannot be taken in a haphazard way. Some procedures must follow others.

- **Valid and verifiable** - this concept implies that whatever you conclude on the basis of your findings is correct and can be verified by you and others.

- **Empirical** - this means that any conclusions drawn are based upon hard evidence gathered from information collected from real life experiences or observations.

- **Critical** - critical scrutiny of the procedures used and the methods employed is crucial to a research enquiry. The process of investigation must be foolproof and free from drawbacks. The process adopted and the procedures used must be able to withstand critical scrutiny.

For a process to be called research, it is imperative that it has the above characteristics.

Types of Research:

Research can be classified from three perspectives:

1. *application* of research study
2. *objectives in undertaking* the research
3. *inquiry mode* employed

Research Application:

From the point of view of application, there are two broad categories of research:

– *pure research* and
– *applied research.*

Pure research involves developing and testing theories and hypotheses that are intellectually challenging to the researcher but may or may not have practical application at the present time or in the future. *The knowledge produced through pure research is sought in order to add to the existing body of research methods.*

Applied research is done to solve specific, practical questions; for policy formulation, administration and understanding of a phenomenon. It can be *exploratory*, but is usually *descriptive*. It is almost always done on the basis of basic research. Applied research can be carried

out by academic or industrial institutions. Often, an academic institution such as a university will have a specific applied research program funded by an industrial partner interested in that program.

Research Objectives:

From the viewpoint of objectives, a research can be classified as:

- *descriptive*
- *correlational*
- *explanatory*
- *exploratory*

Descriptive research attempts to describe systematically a situation, problem, phenomenon, service or programme, or provides information about , say, living condition of a community, or describes attitudes towards an issue.

Correlational research attempts to discover or establish the existence of a relationship/ interdependence between two or more aspects of a situation.

Explanatory research attempts to clarify why and how there is a relationship between two or more aspects of a situation or phenomenon.

Exploratory research is undertaken to explore an area where little is known or to investigate the possibilities of undertaking a particular research study (*feasibility study/pilot study).*

In practice most studies are a combination of the first three categories.

Research Inquiry Mode:

From the process adopted to find answer to research questions – the two approaches are:

- *Structured approach*
- *Unstructured approach*

Structured approach:

The structured approach to inquiry is usually classified as *quantitative research.* Here everything that forms the research process- objectives, design, sample, and the questions that you plan to ask of respondents- is predetermined.
It is more appropriate to determine the *extent* of a problem, issue or phenomenon by quantifying the variation. e.g. how many people have a particular problem? How many people hold a particular attitude?

Unstructured approach:
The unstructured approach to inquiry is usually classified as *qualitative research.* This approach allows flexibility in all aspects of the research process. It is more appropriate to explore the *nature* of a problem, issue or phenomenon *without quantifying it.*
Main objective is to describe the *variation* in a phenomenon, situation or attitude. e.g., description of an observed situation, the historical enumeration of events, an account of different opinions different people have about an issue, description of working condition in a particular industry.

Both approaches have their place in research. Both have their strengths and weaknesses.

In many studies you have to combine both qualitative and quantitative approaches.

For example, suppose you have to find the types of cuisine / accommodation available in a city and the extent of their popularity.

Types of cuisine is the qualitative aspect of the study as finding out about them entails description of the culture and cuisine

The *extent of their popularity* is the quantitative aspect as it involves estimating the number of people who visit restaurant serving such cuisine and calculating the other indicators that reflect the extent of popularity.

Different researchers have categorised research into what suits their discipline or field of research the best. Rajsekar, et. al. (2006) proposes two type of research (basic research and applied research) as detailed below:

Basic Research

Basic research is an investigation on basic principles and reasons for occurrence of a particular event or process or phenomenon. It is also called *theoretical research*. Study or investigations of some natural phenomenon or relating to pure science are termed as *basic research*. Basic researches sometimes may not lead to immediate use or application. It is not concerned with solving any practical problems of immediate interest. But it is original or basic in character. It provides a systematic and deep insight into a problem and facilitates extraction of scientific and logical explanation and conclusion on it. It helps build new frontiers of knowledge. The outcomes of basic research form the basis for many applied research. Researchers working on applied research have to make use of the outcomes of basic research and explore the utility of them.

Research on improving a theory or a method is also referred as fundamental research. For example, suppose a theory is applicable to a system provided the system satisfies certain specific conditions. Modifying the theory to apply it to a general situation is a basic research.

Applied Research

In an *applied research* one solves certain problems employing well known and accepted theories and principles. Most of the experimental research, case studies and interdisciplinary research are essentially applied research. Applied research is helpful for basic research. A research, the outcome of which has immediate application is also termed as *applied research*. Such a research is of practical use to current activity. For example, researches on social problems have immediate use. Applied research is concerned with actual life research such as research on increasing efficiency of a machine, increasing gain factor of production of a material, pollution control, preparing vaccination for a disease, etc. Obviously, they have immediate potential applications.

Other Types of Research

Other types of research include *action research* (fact findings to improve the quality of action in the social world), *explanatory research* (searching explanations for events and phenomena, for example finding answer to the question why are the things like what they are?), *exploratory research* (getting more information on a topic) and *comparative research* (obtaining similarities and differences between events, methods, techniques, etc.). Within each research group, there are classifications of other research categories.

Quantitative and Qualitative Research

The basic and applied researches can be *quantitative* or *qualitative* or even both. Quantitative research is based on the measurement of quantity or amount. Here a process is expressed or described in terms of one or more quantities. Qualitative research is concerned with qualitative phenomenon involving quality. It is non-numerical, descriptive, applies reasoning and uses words. Its aim is to get the meaning, feeling and describe the situation. We measure and weigh things in the study of substance or structure. Can we measure or weigh patterns? We cannot measure or weigh patterns. But to study patterns we must map a configuration of relationships. That is, structures involve quantities whereas patterns involve qualities. If one wishes to investigate why certain data are random then it is a qualitative research. If the aim is to study how random the data is, what is the mean, variance and distribution function then it becomes quantitative. There has been widespread debate in recent years within many of the social sciences regarding the relative merits of quantitative and qualitative strategies for research. The positions taken by individual researchers vary considerably, from those who see the two strategies as entirely separate and based on alternative views of the world, to those who are happy to mix these strategies within their research projects. In exploring the distinctions between qualitative and quantitative forms of research one needs to consider the different ontological and epistemological questions as well as positivism, interpretivism and critical paradigms.

3.2 Research Methodology and Research Method

Research Methods and Research Methodology are two terms that are often confused as one and the same. Strictly speaking they are not so and they show differences between them. One of the primary differences between them is that research methods are the methods by which you conduct research into a subject or a topic. On the other hand research methodology explains the methods by which you may proceed with your research. Research methods involve conduct of experiments, tests, surveys and the like. On the other hand research methodology involves the learning of the various techniques that can be used in the conduct of research and in the conduct of tests, experiments, surveys and critical studies. This is the technical difference between the two terms, namely, research methods and research methodology.

Research methodology is a systematic way to solve a problem. It is a science of studying how research is to be carried out. Essentially, *the procedures by which researchers go about their work of describing, explaining and predicting phenomena are called research methodology.* It is also defined as the study of methods by which knowledge is gained. Its aim is to give the work plan of research.

Research methods are the various procedures, schemes, algorithms, etc. used in research. All the methods used by a researcher during a research study are termed as *research methods*. They are essentially planned, scientific and value-neutral. They include theoretical procedures, experimental studies, numerical schemes, statistical approaches, etc. Research methods help us collect samples, data and find a solution to a problem. Particularly, scientific research methods call for explanations based on collected facts, measurements and observations and not on reasoning alone. They accept only those explanations which can be verified by experiments.

In short it can be said that research methods aim at finding solutions to research problems. On the other hand research methodology aims at the employment of the correct procedures to find out solutions. It is thus interesting to note that research methodology paves the way for research methods to be conducted properly. Research methodology is the beginning whereas research methods are the end of any scientific or non-scientific research.

Let us take for example a subject or a topic, namely, ‘employment of figures of speech in English literature’. In this topic if we are to conduct research, then the research methods that are involved are study of various works of the different poets and the understanding of the employment of figures of speech in their works. On the other hand research methodology pertaining to the topic mentioned above involves the study about the tools of research, collation of various manuscripts related to the topic, techniques involved in the critical edition of these manuscripts and the like.

If the subject into which you conduct a research is a scientific subject or topic then the research methods include experiments, tests, study of various other results of different experiments performed earlier in relation to the topic or the subject and the like. On the other hand research methodology pertaining to the scientific topic involves the techniques regarding how to go about conducting the research, the tools of research, advanced techniques that can be used in the conduct of the experiments and the like. Any student or research candidate is supposed to be good at both

research methods and research methodology if he or she is to succeed in his or her attempt at conducting research into a subject.

Research methods may be understood as all those methods/techniques that are used for conduction of research. *Research methods or techniques, thus, refer to the methods the researchers use in performing research operations*. In other words, all those methods which are used by the researcher during the course of studying his research problem are termed as research methods. Since the object of research, particularly the applied research, is to arrive at a solution for a given problem, the available data and the unknown aspects of the problem have to be related to each other to make a solution possible. Keeping this in view, research methods can be put into the following three groups:

1. In the first group we include those methods which are concerned with the collection of data. These methods will be used where the data already available are not sufficient to arrive at the required solution;

2. The second group consists of those statistical techniques which are used for establishing relationships between the data and the unknowns;

3. The third group consists of those methods which are used to evaluate the accuracy of the results obtained.

Research methods falling in the above stated last two groups are generally taken as the analytical tools of research.

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. It is necessary for the researcher to know not only the research methods/techniques but also the methodology. Researchers not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why. Researchers also need to understand the assumptions underlying various techniques and they need to know the

criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem. For example, an architect, who designs a building, has to consciously evaluate the basis of his decisions, i.e., he has to evaluate why and on what basis he selects particular size, number and location of doors, windows and ventilators, uses particular materials and not others and the like. Similarly, in research the scientist has to expose the research decisions to evaluation before they are implemented. He has to specify very clearly and precisely what decisions he selects and why he selects them so that they can be evaluated by others also.

From what has been stated above, we can say that research methodology has many dimensions and research methods do constitute a part of the research methodology. The scope of research methodology is wider than that of research methods. *Thus, when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others*.

3.3 Research Methodology

Research methodology is a collective term for the structured process of conducting research. There are many different methodologies used in various types of research and the term is usually considered to include research design, data gathering and data analysis. Research methodology seeks to inform: Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, why particular technique of analysing data has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study.

Research methodologies can be quantitative (for example, measuring the number of times someone does something under certain conditions) or qualitative (for example, asking people how they feel about a certain situation). Ideally, comprehensive research should try to incorporate both qualitative and quantitative methodologies but this is not always possible, usually due to time and financial constraints. Research methodologies are generally used in academic research to test

hypotheses or theories. A good design should ensure the research is valid, i.e. it clearly tests the hypothesis and not extraneous variables, and that the research is reliable, i.e. it yields consistent results every time.

Part of the research methodology is concerned with the how the research is conducted. This is called the study design and typically involves research conducted using questionnaires, interviews, observation and/or experiments. The term research methodology, which prescribes the research method to use, usually encompasses the procedures followed to analyze and interpret the data gathered. These often use a range of sophisticated statistical analyses of the data to identify correlations or statistical significance in the results.

Objective, representative research can be difficult to conduct because tests can normally only be conducted on a small sample (e.g. you cannot test a drug on every person in the world so a sample needs to be used in research). This means that researchers need to have a very detailed understanding of the types and limitations of research methodologies which they are using.

In simple terms research methodology is used to give a clear cut idea on what the researcher is carrying out his or her research. In order to plan in a right point of time and to advance the research work, research methodology makes the right platform to the researcher to mapping out the research work in relevance to make solid plans. More over research methodology guides the researcher to involve and to be active in his or her particular field of enquiry. Most of the time, the aim of the research and the research topic won't be same at all time it varies from its objectives and flow of the research, but by adopting a suitable methodology this can be achieved.

Right from selecting the topic and carrying out the research, the research methodology drives the researcher in the right track. The entire research plan is based on the concept of right research methodology. More over through the research methodology the external environment constitutes the research by giving an in-depth idea on setting the right research objective, followed by literature point of view, based on that chosen analysis through interviews or questionnaires findings will be obtained and finally concluded message by this research.

The research methodology constitutes the internal environment by understanding and identifying the right type of research, strategy, philosophy, time horizon, approaches, followed by right procedures and techniques based on his or her research work. Additionally, the research

methodology acts as the nerve center because the entire research is bounded by it and to perform a good research work, the internal and external environment has to follow the right research methodology process.

The system of collecting data for research projects is known as research methodology. The data may be collected for either theoretical or practical research for example management research may be strategically conceptualized along with operational planning methods and change management. Some important factors in research methodology include validity of research data, ethics and the reliability of most of your work is finished by the time you finish the analysis of your data. This is followed by research design, which may be either experimental or quasi-experimental. The last two stages are data analysis and finally writing the research paper, which is organised carefully into graphs and tables so that only important relevant data is shown.

Importance of Research Methodology in Research

It is necessary for a researcher to design a research methodology for the problem chosen. One should note that even if the research method considered for two problems are same the research methodology may be different. It is important for the researcher to know not only the research methods necessary for the research under taken but also the methodology. For example, a researcher not only needs to know how to calculate mean, variance and distribution function for a set of data, how to find a solution of a physical system described by mathematical model, how to determine the roots of algebraic equations and how to apply a particular method but also need to know (i) which is a suitable method for the chosen problem?, (ii) what is the order of accuracy of the result of a method?, (iii) what is the efficiency of the method? And so on. Considerations of these aspects constitute a research methodology. More precisely, research methods help us get a solution to a problem. On the other hand, research methodology is concerned with the explanation of the following:

(1) Why is a particular research study undertaken? (2) How did one formulate a research problem? (3) What types of data were collected? (4) What particular method has been used? (5) Why was a particular technique of analysis of data used?

The study of research methods gives training to apply them to a problem. The study of research methodology provides us the necessary training in choosing research methods, materials, scientific tools and training in techniques relevant for the problem chosen.

Research methodology includes a philosophically coherent collection of theories, concepts or ideas as they relate to a particular discipline or field of inquiry. Methodology refers to more than a simple set of methods; rather it refers to the rationale and the philosophical assumptions that underlie a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers. This section does more than outline the researchers' methods (for example, "we conducted a survey of 50 people over a two-week period and subjected the results to statistical analysis", etc.); it might explain what the researchers' ontological or epistemological views are. Researchers acknowledge the need for rigor, logic, and coherence in their research methodologies, which are subject to peer review.

3.3.1 Types of Research Methodologies

Traditionally, research methodologies are broadly classified into qualitative and quantitative thereby creating a huge divide amongst researchers, especially in social sciences (Onwuegbuzie and Leech, 2005). The difference between these two methods has been prominent in many research methods publications (Howe, 1988; Neuman, 1997). For instance, Myers (2009, p. 8) distinguishes that qualitative research is an in-depth study of social and cultural phenomena and focuses on text whereas quantitative research investigates general trends across population and focuses on numbers. Likewise, Miles and Huberman (1994) maintain that qualitative research focuses on in-depth examination of research issues while Harrison (2001) argues that quantitative design provides broad understanding of issues under investigation.

As ascertained by reputable research methodologies researchers above, we can conclude that there are two main types of research methodology, 1- Quantitative methodology, 2- Qualitative methodology.1- Quantitative research methodology is the type by which you test the significance of your hypothesis, in other words you answer the words: How much? Is there a relationship? Quantitative research methods tend to be systematic and use numbers. However, 2- Qualitative methodology is the type by which you are depending on your observations and descriptions. It is subjectively and descriptive, no facts. This kind of method is used to assess knowledge's, attitudes, behaviours, and opinions of people depending on the topic of your research. Researchers in this

type of method use his opinion and experiences which are not allowed to be used in quantitative method at all.

Given this distinction, purists uphold that research questions are usually oriented towards quantitative or qualitative direction and as such these two methodologies should not go hand-in-hand (Howe, 1988; Smith and Heshusius, 1986). Consequently, Myers (2009) supports the purists' view of separating the two research philosophies by citing examples of research techniques under the two main categories in his recent publication on 'Qualitative Research in Business and Management'. Thus, qualitative research methods include action research, case study, ethnography, grounded research, semiotics, discourse analysis, hermeneutics and narrative while quantitative research methods encompass surveys, simulation, mathematical modelling, laboratory experiments, statistical analysis, econometric and structured equations modelling (Myers, 2009, p.8).
From the purists' perspective, the disparity between the qualitative and quantitative paradigms emanates from the fact that epistemological, ontological and axiological hypotheses of research issues are usually qualitative or quantitative in nature (Tashakkori and Teddlie, 1998).

However, pragmatic researchers debunk the dichotomy between purists' belief of qualitative and quantitative methodologies but rather engage in arguments that reveal similarities between the two and promote triangulation (Onwuegbuzie and Leech, 2005; Tashakkori and Teddlie, 1998; Newman and Benz, 1998). In this respect, mixing qualitative with quantitative methods provides opportunity to corroborate results from diverse methods of studying a given phenomenon in a more rigorous manner (Neuman, 1997). Though the pragmatic researchers argue that mono-method research is a danger to the advancement of social sciences and wonder how stakeholders may develop confidence in findings from singular methods, they support the fact that the choice of research methods must reflect the research questions being addressed (Onwuegbuzie and Leech, 2005; Sechrest and Sadani, 1995). In the mist of this debate, researchers, particularly the inexperienced ones may find it difficult to select the appropriate methodologies for a given study.

The basic and applied researches can be *quantitative* or *qualitative* or even both. Quantitative research is based on the measurement of quantity or amount. Here a process is expressed or described in terms of one or more quantities. Qualitative research is concerned with qualitative phenomenon involving quality. It is non-numerical, descriptive, applies reasoning and uses words. Its aim is to get the meaning, feeling and describe the situation. We measure and weigh things in

the study of substance or structure. Can we measure or weigh patterns? We cannot measure or weigh patterns. But to study patterns we must map a configuration of relationships. That is, structures involve quantities whereas patterns involve qualities. If one wishes to investigate why certain data are random then it is a qualitative research. If the aim is to study how random the data is, what is the mean, variance and distribution function then it becomes quantitative. Explaining how digestion of food takes place in our body is a qualitative description. It does not involve any numbers or data and quantities. Determination of exact amount of a particular compound present in a volume is essentially quantitative analysis.

Qualitative and Quantitative Research Methodology

The above description of the types of research methodologies brings to light the fact that there are two basic approaches to research, viz., *quantitative approach* and the *qualitative approach*. The former involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis in a formal and rigid fashion. Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. Attitude or opinion research i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research.

Reviewing these definitions of what is meant by quantitative versus qualitative research helps identify the reasons for the primarily separate use of each method and the continuing debate among researchers concerning the relative value of each approach. The arguments can be complicated and often are philosophical; however, they essentially make the following kinds of distinctions.

The word qualitative implies an emphasis on processes and meanings that are not rigorously examined or measured (if measured at all), in terms of quantity, amount, intensity, or frequency. Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry. In contrast, quantitative studies emphasize the measurement and analysis of causal relationships between variables, not processes. Inquiry is purported to be within a value-free framework

While it may be somewhat naive to delineate the differences between qualitative and quantitative research so definitively, it is helpful to begin to understand the nature of the debate by

understanding commonly held divisions and basic definitions. Simply put, the terms 'qualitative' and 'quantitative' should refer to the type of *data* generated in the research process. Quantitative research produces data in the form of numbers while qualitative research tends to produce data that are stated in prose or textual forms. In order to produce different types of data, qualitative and quantitative research tend to employ different *methods*.

Using the terminology from Hentschel's (1999) Research Methodology-Data Framework (Figure 3.1 below) non-contextual methods—applied across the population universe, often a country or region—are designed to achieve breadth in coverage and analysis. Typically, the random sample survey produces quantifiable data that can be statistically analysed with the main aim of measuring, aggregating, modelling and predicting behaviour and relations. Contextual methods in contrast are applied to a specific locality, case or social setting and sacrifice breadth of population coverage and statistical generalisability in order to explore issues in depth (Booth et al, 1998). Contextual research includes ethnographic techniques, such as participant observation, interviews and participatory tools that are often group-based and visual. Using open-ended questions these methods are designed to capture judgements and perceptions and allow complex analyses of often non-quantifiable cause-and-effect processes.

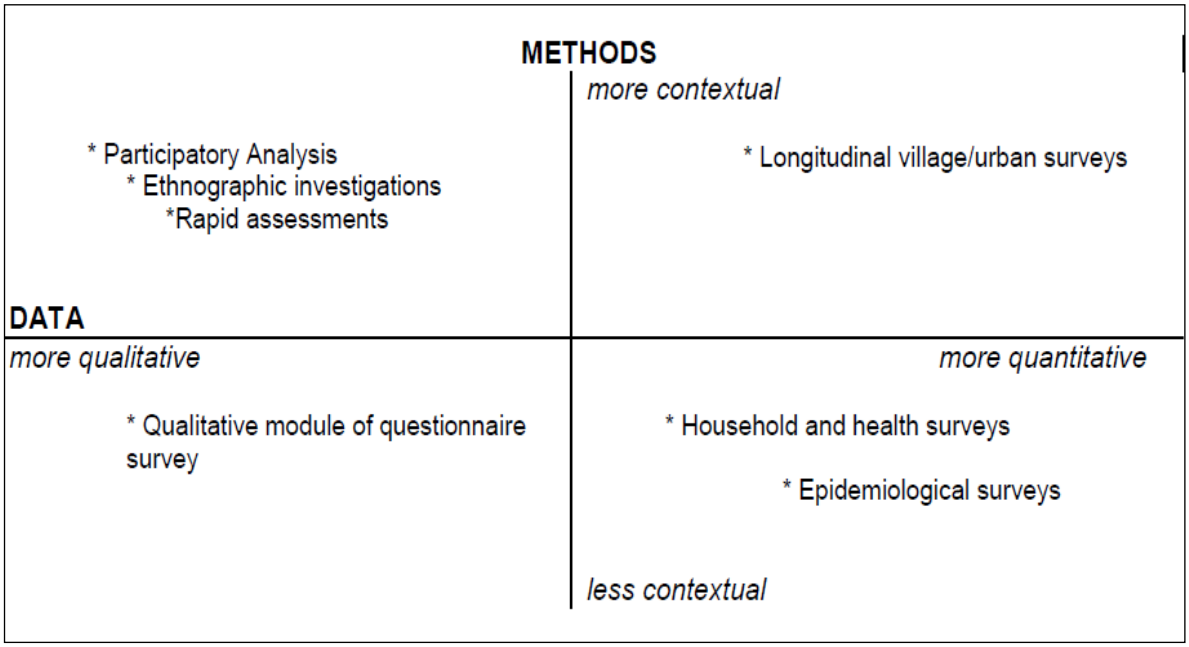

Figure 3.1: The Research Methodology Framework
Source: Hentschel (1999)

There has been widespread debate in recent years within many of the social sciences regarding the relative merits of quantitative and qualitative strategies for research. The positions taken by individual researchers vary considerably, from those who see the two strategies as entirely separate and based on alternative views of the world, to those who are happy to mix these strategies within

their research projects. For example, Bryman (1988) argued for a `best of both worlds' approach and suggested that qualitative and quantitative approaches should be combined. Hughes (1997), nevertheless, warns that such technicist solutions underestimate the politics of legitimacy that are associated with choice of methods. In particular, quantitative approaches have been seen as more scientific and `objective'.

3.3.2 Qualitative Research Methodology

When it comes to dealing with large sample size, quantitative research reaffirms the axiom "bigger is better." Yet when it comes to dealing with smaller, more focused samples, qualitative research proves that "size doesn't matter." Qualitative research is a highly subjective research discipline, designed to look beyond the percentages to gain an understanding of feelings, impressions and viewpoints.

The qualitative paradigm is based on interpretivism (Altheide and Johnson, 1994; Kuzel and Like, 1991; Secker et al., 1995) and constructivism (Guba and Lincoln, 1994). Ontologically speaking, there are multiple realities or multiple truths based on one’s construction of reality. Reality is socially constructed (Berger and Luckmann, 1966) and so is constantly changing. On an epistemological level, there is no access to reality independent of our minds, no external referent by which to compare claims of truth (Smith, 1983). The investigator and the object of study are interactively linked so that findings are mutually created within the context of the situation which shapes the inquiry (Guba and Lincoln, 1994; Denzin and Lincoln, 1994).

Gaining such insight into the hearts and minds of the people is best acquired through the use of smaller, highly targeted samples. Expert moderators, unencumbered by the strict time and structure constraints of a quantitative survey, use a multitude of techniques to obtain in-depth information. Interviews are lengthy, oftentimes as long as four hours, allowing the moderator to elicit extremely candid, highly complex responses. The result is rich, in-depth data laden with insight unobtainable from quantitative research techniques.

Good, sound qualitative research has many strengths. It's flexible, highly-focused, and designed to be completed quickly because the results are seen or heard first-hand, readers relates to the findings easily.

Qualitative research is not without its weaknesses and limitations. Misuse or misunderstanding the capabilities of qualitative research is commonplace. Researchers often fall in love with the data-rich results and assume that the results are projectable. This assumption is incorrect. Because the analysis is subjective and deals with a sample size, projectability is not possible. Another common misconception is the expectation that qualitative research will always produce definitive conclusions. In reality, the results will not provide researchers with definitive conclusions, but only with enough information to establish a firm basis for decision making.

Trained researchers are essential to the success of qualitative research. Placed in the hands of untrained researchers, a qualitative research study's chance of success is vastly diminished. When you are ready to pull the trigger on your research study and can't decide which methodology to choose, just remember your axioms. When you want "strength in numbers," choose quantitative research. When "size doesn't matter," qualitative research is your best bet.

Qualitative Research - Key Characteristics

Events can be understood adequately only if they are seen in context. Therefore, a qualitative researcher immerses her/himself in the setting.

The contexts of inquiry are not contrived; they are natural. Nothing is predefined or taken for granted.

Qualitative researchers want those who are studied to speak for themselves, to provide their perspectives in words and other actions. Therefore, qualitative research is an interactive process in which the persons studied teach the researcher about their lives.

Qualitative researchers attend to the experience as a whole, not as separate variables. The aim of qualitative research is to understand experience as unified.

Qualitative methods are appropriate to the above statements. There is no one general method.

For many qualitative researchers, the process entails appraisal about what was studied.

Ely et al add the following from Sherman and Webb (1988) to their definition: Qualitative implies a direct concern with experience as it is `lived' or `felt' or `undergone' ... Qualitative research, then, has the aim of understanding experience as nearly as possible as its participants feel it or live it.

Qualitative Research - Strengths and Limitations

Strengths

- Because of close researcher involvement, the researcher gains an insider's view of the field. This allows the researcher to find issues that are often missed (such as subtleties and complexities) by the scientific, more positivistic enquiries.

- Qualitative descriptions can play the important role of suggesting possible relationships, causes, effects and dynamic processes.

- Because statistics are not used, but rather qualitative research uses a more descriptive, narrative style, this research might be of particular benefit to the practitioner as she or he could turn to qualitative reports in order to examine forms of knowledge that might otherwise be unavailable, thereby gaining new insight.

- Qualitative research adds flesh and blood to social analysis.

Limitations

- The problem of adequate validity or reliability is a major criticism. Because of the subjective nature of qualitative data and its origin in single contexts, it is difficult to apply conventional standards of reliability and validity.

- Contexts, situations, events, conditions and interactions cannot be replicated to any extent nor can generalisations be made to a wider context than the one studied with any confidence.

- The time required for data collection, analysis and interpretation is lengthy.

- Researcher's presence has a profound effect on the subjects of study.

- Issues of anonymity and confidentiality present problems when selecting findings.

- The viewpoints of both researcher and participants have to be identified and elucidated because of issues of bias.

3.3.3 Quantitative Research Methodology

Strength in numbers characterizes the many advantages of quantitative research. A numbers-based research discipline, quantitative research statistically measures attitudes, behaviour, and performance and provides results in percentages that are easier to interpret. Utilizing a series of tests and techniques, quantitative research will often yield data that's projectable to a larger population. Because it is so deeply rooted in numbers and statistics, quantitative research has the ability to effectively translate data into easily quantifiable charts and graphs. Real-world examples have shown the effectiveness of quantitative research in measuring awareness, establishing profiles, and determining future needs.

The quantitative paradigm is based on positivism. Science is characterized by empirical research; all phenomena can be reduced to empirical indicators which represent the truth. The ontological position of the quantitative paradigm is that there is only one truth, an objective reality that exists independent of human perception. Epistemologically, the investigator and investigated are independent entities. Therefore, the investigator is capable of studying a phenomenon without influencing it or being influenced by it; “inquiry takes place as through a one way mirror” (Guba and Lincoln, 1994: 110).

Quantitative research consists of those studies in which the data concerned can be analysed in terms of numbers. Quantitative research is based more directly on its original plans and its results are more readily analysed and interpreted. Quantitative research is, as the term suggests, concerned with the collection and analysis of data in numeric form. It tends to emphasize relatively large-scale and representative sets of data, and is often, falsely in our view, presented or perceived as being about the gathering of `facts'.

However, quantitative research does have its limitations. Large samples are required, and the logistical difficulties inherent in gathering a sufficiently large sample can sabotage the study before it even gets off the ground. Larger samples also tend to be more expensive. Quantitative research, by virtue of its short (usually 20 minute) interviews and rigid structure, is not the most flexible method of research and, when handled improperly, is especially vulnerable to statistical error. The

misuse of sampling and weighting can completely undermine the accuracy, validity, and projectability of a quantitative research study.

Quantitative Research - Key Characteristics

Control: This is the most important element because it enables the scientist to identify the causes of his or her observations. Experiments are conducted in an attempt to answer certain questions. They represent attempts to identify why something happens, what causes some event, or under what conditions an event does occur. Control is necessary in order to provide unambiguous answers to such questions. To answer questions in education and social science we have to eliminate the simultaneous influence of many variables to isolate the cause of an effect. Controlled inquiry is absolutely essential to this because without it the cause of an effect could not be isolated.

Operational Definition: This means that terms must be defined by the steps or operations used to measure them. Such a procedure is necessary to eliminate any confusion in meaning and communication. Consider the statement `Anxiety causes students to score poorly in tests'. One might ask, `What is meant by anxiety?' Stating that *anxiety* refers to being tense or some other such term only adds to the confusion. However, stating that anxiety refers to a score over a criterion level on an anxiety scale enables others to realise what you mean by anxiety. Stating an operational definition forces one to identify the empirical referents, or terms. In this manner, ambiguity is minimised. Again, *introversion* may be defined as a score on a particular personality scale, *hunger* as so many hours since last fed, and *social class* as defined by occupation.

Replication: To be replicable, the data obtained in an experiment must be reliable; that is, the same result must be found if the study is repeated. If observations are not repeatable, our descriptions and explanations are thought to be unreliable.

Hypothesis Testing: The systematic creation of a hypothesis and subjecting it to an empirical test.

Quantitative Research - Strengths and Limitations

Strengths

- Precision - through quantitative and reliable measurement
- Control - through sampling and design

- Ability to produce causality statements, through the use of controlled experiments
- Statistical techniques allow for sophisticated analyses
- Replicable

Limitations

- Because of the complexity of human experience it is difficult to rule out or control all the variables;
- Because of human agency people do not all respond in the same ways as inert matter in the physical sciences;
- Its mechanistic ethos tends to exclude notions of freedom, choice and moral responsibility;
- Quantification can become an end in itself.
- It fails to take account of people's unique ability to interpret their experiences, construct their own meanings and act on these.
- It leads to the assumption that facts are true and the same for all people all of the time.
- Quantitative research often produces banal and trivial findings of little consequence due to the restriction on and the controlling of variables.
- It is not totally objective because the researcher is subjectively involved in the very choice of a problem as worthy of investigation and in the interpretation of the results.
- The type of research and the format of research findings are limitations as well.

3.4 Research Methodology Used

The most important component of any research is the research methodology and the resulting research method that is systematically applied to conduct the research, analyse and report the findings and draw a conclusion to answer the research question thus solving the research problem. To decide on the research methodology to use in this research, two critical questions were required to be considered:

1. **What type of data was going to be collected for the research?, and;**

2. **The format in which the research findings were going to be analysed and reported?**

Apart from the above major two questions, there are other factors to consider when deciding which research methodology to use. Some of them are:

- **Research Questions:** What exactly are you trying to find out? Focus on the `exactly' as this can lead you either into the quantitative or qualitative direction.

- **Are we interested in making standardized and systematic comparisons or do we really want to study this phenomenon or situation in detail?**

- **The Literature:** How have other researchers dealt with this topic? To what extent do you wish to align your own research with standard approaches to the topic?

- **Practical Considerations:** Issues of time, money, availability of samples and data, familiarity with the subject under study, access to situations, gaining co-operation.

- **Knowledge payoff:** Will we learn more about this topic using quantitative or qualitative approaches? Which approach will produce more useful knowledge? Which will do more good?

- **Style:** Some people prefer one to the other. This may involve paradigm and philosophical issues or different images about what a good piece of research looks like.

The question of whether to use quantitative research methodology or qualitative research methodology is commonly asked, especially by beginning researchers. Often, they are putting the `methods cart' before the `content horse'. The best advice in those cases is to step back from

questions of method, and give further consideration to the purposes and research questions, bearing in mind that the way questions are asked influences what needs to be done to answer them. But when that has been done, and the question still remains, the above factors help in making the decision. Of course, a reasonable decision in any study might be to combine the two approaches.

Given the above, **Qualitative Research Methodology** seemed the most appropriate research methodology to use in this research. The logic behind using this research methodology is as above and the justification is as follows:

Type of Data: the data, which is in the form of information will be collected from research papers, journal articles, web sites, and web blogs using the Internet. The data collected in the form of information is textual, and thus can be analysed using the qualitative research methodology.

Format of Research Findings: again to answer the research questions, percentages and statistics could not be used as research was asking "how" and "what" questions which needed descriptive answer in textual format, and thus the use qualitative research methodology was required.

Research Questions: what "exactly" I was trying to find out could be best answered with qualitative data in the form of research papers and journal articles with the qualitative research methodology. To fill the knowledge gap, information was required to be collated, analysed, and conclusions drawn. Percentage and statistics of quantitative research methodology would make no sense.

Study in Detail: to adequately solve the research problem, the situation or phenomena, cloud computing with mobile phones opportunities and issues for developing countries needed to be studied in detail. Qualitative research methodology is most appropriate in such situations. A quantitative comparison or systematic standardisation would not suffice.

Existing Similar Literature: though there were not much research that existed on the similar topic to this research, other researchers on cloud computing had done qualitative research as well. There is comprehensive literature around that suggests the use of qualitative research methodology in information systems (Myers, 2009). Cloud computing aligns itself to the field of information systems.

Practical Considerations: as this research looked at opportunities and issues of cloud computing with mobile phones in developing countries, time constraints and funding issues would not permit primary investigation and data collection from all developing countries. However, secondary data in qualitative format was readily available and could be easily accessed via the Internet for this research.

Knowledge Acquisition: not much would be learnt through this research from quantitative analysis. We could say that the usage of mobile cloud computing will increase by 100% in the next 5 years using quantitative research methodology. But that is not good enough. We want to know "why" and "how", we want to know more, we want to know everything possible – that is the reason for doing research, "**to know as much as possible"**. Qualitative research methodology is the key to know as much as possible.

Availability of Secondary Data: probably another important criterion that made this research use qualitative research methodology would be the abundance of secondary data that was available at the click of a mouse. As pointed out by Argyrous (2009), "secondary data are an abundant resource for researchers" as the Internet has made vast amount of data available. He also lists the advantages of savings on cost and time, access to quality data that has been tested, access to difficult populations and availability of longitudinal data.

Subject under Study: the researcher is intimately involved in research on cloud computing since it became the buzz word within the IT Industry. He started off by writing research papers on understanding cloud computing, after a series of other research publications on the same topic, found a knowledge gap and narrowed it down to this research dissertation.

Quantitative Research Methodology: however, there are several sections, percentage and statistics provided with the assistance of quantitative analysis to strengthen the case of mobile cloud computing for developing countries.

3.5 Research Method

Research methods are a variety of techniques that people use when studying a given phenomenon. They are planned, scientific, and value-neutral. What that means is that good research methods don't "just happen." Instead, they are deliberately employed in a way that is designed to maximize the accuracy of the results. Research methods are concerned with use of any of the following:

theoretical methods, numerical techniques, experimental techniques and other relevant data and tools necessary for the research study. It is not necessary that every theory, technique and information in the topic of research is useful for a particular problem. A researcher has to identify and select materials which are useful to his research study.

The function of the research method is to provide for the collection of relevant information with minimal expenditure of effort, time and money. The design of research method, appropriate for a particular research problem, involves the consideration of the following: 1). Objectives of the Research Study; 2). Method of Data Collection to be Adopted; 3). Source of Data or Information; 4). Tool for Data Collection; and 5). Data Analysis - Qualitative and Quantitative

The goal of the research method is to produce new knowledge, or deepen understanding of a topic or issue. This process takes three main forms:

Exploratory Research

Exploratory research is a type of research conducted for a problem that has not been clearly defined. Exploratory research helps determine the best research design, data collection method and selection of subjects. It should draw definitive conclusions only with extreme caution. Given its fundamental nature, exploratory research often concludes that a perceived problem does not actually exist.

Exploratory research often relies on secondary research such as reviewing available literature and/or data, or qualitative approaches such as informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies. The Internet allows for research methods that are more interactive in nature. For example, RSS feeds efficiently supply researchers with up-to-date information; major search engine search results may be sent by email to researchers by services such as Google Alerts; comprehensive search results are tracked over lengthy periods of time by services such as Google Trends; and websites may be created to attract worldwide feedback on any subject.

The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation. Although the results of qualitative

research can give some indication as to the "why", "how" and "when" something occurs, it cannot tell us "how often" or "how many".

Social exploratory research "seeks to find out how people get along in the setting under question, what meanings they give to their actions, and what issues concern them. The goal is to learn 'what is going on here?' and to investigate social phenomena without explicit expectations." This methodology is also at times referred to as a grounded theory approach to qualitative research or interpretive research, and is an attempt to unearth a theory from the data itself rather than from a predisposed hypothesis.

Babbie (1989) identifies three purposes of social science research. The purposes are exploratory, descriptive and explanatory. Exploratory research is used when problems are in a preliminary stage. Exploratory research is used when the topic or issue is new and when data is difficult to collect. Exploratory research is flexible and can address research questions of all types (what, why, how). Exploratory research is often used to generate formal hypotheses. Shields & Tajalli (2006) link exploratory research with the conceptual framework working hypothesis.

Skeptics, however, have questioned the usefulness and necessity of exploratory research in situations where priori analysis could be conducted instead

Constructive Research

Constructive research is perhaps the most common computer science research method. This type of approach demands a form of validation that doesn’t need to be quite as empirically based as in other types of research like exploratory research. Nevertheless the conclusions have to be objectively argued and defined. This may involve evaluating the “construct” being developed analytically against some predefined criteria or performing some benchmark tests with the prototype. The term “construct” is often used in this context to refer to the new contribution being developed. Construct can be a new theory, algorithm, model, software, or a framework

Empirical Research

Empirical research is a way of gaining knowledge by means of direct and indirect observation or experience. Empirical evidence (the record of one's direct observations or experiences) can be

analyzed quantitatively or qualitatively. Through quantifying the evidence or making sense of it in qualitative form, a researcher can answer empirical questions, which should be clearly defined and answerable with the evidence collected (usually called data). Research design varies by field and by the question being investigated. Many researchers combine qualitative and quantitative forms of analysis to better answer questions which cannot be studied in laboratory settings, particularly in the social sciences and in education.

In some fields, quantitative research may begin with a research question (e.g., "Does listening to vocal music during the learning of a word list have an effect on later memory for these words?") which is tested through experimentation in a lab. Usually, a researcher has a certain theory regarding the topic under investigation. Based on this theory some statements, or hypotheses, will be proposed (e.g., "Listening to vocal music has a negative effect on learning a word list."). From these hypotheses predictions about specific events are derived (e.g., "People who study a word list while listening to vocal music will remember fewer words on a later memory test than people who study a word list in silence."). These predictions can then be tested with a suitable experiment. Depending on the outcomes of the experiment, the theory on which the hypotheses and predictions were based will be supported or not.

Many researchers and research literature have been found to interchange references and mix definitions and meanings of research methodology, research methods, research design, and research approach. I have attempted to separate them according to my understanding.

3.5.1 Types of Research Methods

As the academic field of Information Systems has developed, IS researchers have become increasingly interested in the nature of the discipline, its publication outlets, and its accomplishments. Some have suggested that such self reflection is beneficial; by understanding our past accomplishments, the community can better direct its future efforts in the most productive manner (Alavi & Carlson, 1992).

Myers and Liu (2009) surveyed all the research articles in the AIS basket of six top journals over a ten year period, from 1998 to 2007.Within this category they classified articles as using the following research methods: survey, case study, laboratory experiment, field experiment, or action research.

They describe the five research methods as follows:

Survey: Studies employing this research method gather data through the form of questionnaires, which can be paper-based or web-based.

Case study: Studies employing this research method undertake data collection at one or several sites, usually over a period of time; data is usually obtained from "multiple sources of evidence" including interviews and documents. (Yin, 1994)

Laboratory experiment: Studies undertaking laboratory experiments aim for control over the independent variables being measured. Participants and/or groups are usually subject to randomly assigned treatments.

Field experiment: As opposed to the controlled environment of a laboratory experiment, field experiments are conducted within a naturally-occurring system. As such, researchers often do not have control over variables under measurement.

Action research: Studies using action research aim to solve a practical problem in the research setting while also contributing to knowledge about the phenomenon. Action research is a reflective process of progressive problem solving led by individuals working with others in teams or as part of a "community of practice".
In social sciences and later in other disciplines, such as information technology, the following two research methods can be applied, depending on the properties of the subject matter and on the objective of the research:

Qualitative Research

Understanding of human behavior and the reasons that govern such behaviour. Asking a broad question and collecting word-type data that is analyzed searching for themes. This type of research looks to describe a population without attempting to quantifiably measure variables or look to potential relationships between variables. It is viewed as more restrictive in testing hypotheses because it is extremely expensive and time consuming, and typically limited to a single set of

research subjects. Qualitative research is often used as a method of exploratory research as a basis for later quantitative research hypotheses.

Quantitative Research

Systematic empirical investigation of quantitative properties and phenomena and their relationships. Asking a narrow question and collecting numerical data to analyze utilizing statistical methods. The quantitative research designs are experimental, correlational, and survey (or descriptive). Statistics derived from quantitative research can be used to establish the existence of associative or causal relationships between variables. The Quantitative data collection methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories. They produce results that are easy to summarize, compare, and generalize.

Quantitative research is concerned with testing hypotheses derived from theory and/or being able to estimate the size of a phenomenon of interest. Quantitative research uses statistics and mathematics to report research findings. Depending on the research question, participants may be randomly assigned to different treatments. If this is not feasible, the researcher may collect data on participant and situational characteristics in order to statistically control for their influence on the dependent, or outcome, variable. If the intent is to generalize from the research participants to a larger population, the researcher will employ probability sampling to select participants.

3.5.2 Qualitative Research Methods

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena. Examples of qualitative research methods are action research, case study research and ethnography. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Myers 2009). The motivation for doing qualitative research, as opposed to quantitative research, comes from the observation that, if there is one thing which distinguishes humans from the natural world, it is our ability to talk! Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live. Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the point of

view of the participants and its particular social and institutional context is largely lost when textual data are quantified.

Just as there are various philosophical perspectives which can inform qualitative research, so there are various qualitative research methods. A research method is a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection. The choice of research method influences the way in which the researcher collects data. Specific research methods also imply different skills, assumptions and research practices. The four research methods that will be discussed here are action research, case study research, ethnography and grounded theory.

1. Action Research

There are numerous definitions of action research, however one of the most widely cited is that of Rapoport's, who defines action research in the following way:

Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework (Rapoport, 1970, p. 499).

This definition draws attention to the collaborative aspect of action research and to possible ethical dilemmas which arise from its use. It also makes clear, as Clark (1972) emphasizes, that action research is concerned to enlarge the stock of knowledge of the social science community. It is this aspect of action research that distinguishes it from applied social science, where the goal is simply to apply social scientific knowledge but not to add to the body of knowledge.

Action research has been accepted as a valid research method in applied fields such as organization development and education. In information systems, however, action research was for a long time largely ignored, apart from one or two notable exceptions (e.g. Checkland, 1991). More recently, there seems to be increasing interest in action research.

A brief overview of action research is the article by Susman and Evered (1988). The article by Baskerville and Wood-Harper (1996) provides a good introduction to how action research might

be used by IS researchers. An empirical example of action research is the article by Ytterstad et al. (1996).

2. Case Study Research

The term "case study" has multiple meanings. It can be used to describe a unit of analysis (e.g. a case study of a particular organisation) or to describe a research method. The discussion here concerns the use of the case study as a research method.

Case study research is the most common qualitative method used in information systems (Orlikowski and Baroudi, 1991; Alavi and Carlson, 1992). Although there are numerous definitions, Yin (2002) defines the scope of a case study as follows:

A case study is an empirical inquiry that:

> *investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin 2002).*

Case study research can be positivist, interpretive, or critical, depending upon the underlying philosophical assumptions of the researcher. Yin (2002) and Benbasat et al. (1987) are advocates of positivist case study research, whereas Walsham (1993) is an advocate of interpretive in-depth case study research.

3. Ethnography

Ethnographic research comes from the discipline of social and cultural anthropology where an ethnographer is required to spend a significant amount of time in the field. Ethnographers immerse themselves in the lives of the people they study (Lewis 1985, p. 380) and seek to place the phenomena studied in their social and cultural context.

After early ground-breaking work by Wynn (1979), Suchman (1987) and Zuboff (1988), ethnography has now become more widely used in the study of information systems in organizations, from the study of the development of information systems (Hughes et. al, 1992; Orlikowski, 1991; Preston, 1991) to the study of aspects of information technology management (Davies, 1991; Davies and Nielsen, 1992). Ethnography has also been discussed as a method

whereby multiple perspectives can be incorporated in systems design (Holzblatt and Beyer, 1993) and as a general approach to the wide range of possible studies relating to the investigation of information systems (Pettigrew, 1985).

In the area of the design and evaluation of information systems, some very interesting work is taking place in a collaborative fashion between ethnographers on the one hand, and designers, IS professionals, computer scientists and engineers on the other. This collaborative work is especially strong in the UK and Europe and is growing in the US.

4. Grounded Theory

Grounded theory is a research method that seeks to develop theory that is grounded in data systematically gathered and analyzed. According to Martin and Turner (1986), grounded theory is "an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data." The major difference between grounded theory and other methods is its specific approach to theory development - grounded theory suggests that there should be a continuous interplay between data collection and analysis.

Grounded theory approaches are becoming increasingly common in the IS research literature because the method is extremely useful in developing context-based, process-oriented descriptions and explanations of the phenomenon.

3.5.3 Quantitative Research Methods

According to Cohen (1980), quantitative research is defined as social research that employs empirical methods and empirical statements. 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).'

In the social sciences, quantitative research refers to the systematic empirical investigation of social phenomena via statistical, mathematical or computational techniques. The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to phenomena. The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships. Quantitative data is any data that is in numerical form such as statistics, percentages, etc. In layman's terms, this means that the quantitative researcher asks a specific, narrow question and collects numerical data from participants to answer the question. The researcher analyzes the data with the help of statistics. The researcher is hoping the numbers will yield an unbiased result that can be generalized to some larger population. Qualitative research, on the other hand, asks broad questions and collects word data from participants. The researcher looks for themes and describes the information in themes and patterns exclusive to that set of participants. (Source: Wikipedia, 2011)

Quantitative research is used widely in social sciences such as psychology, economics, sociology, and political science, and less frequently in anthropology and history. Research in mathematical sciences such as physics is also 'quantitative' by definition, though this use of the term differs in context. In the social sciences, the term relates to empirical methods, originating in both philosophical positivism and the history of statistics, which contrast qualitative research methods. Qualitative methods produce information only on the particular cases studied, and any more general conclusions are only hypotheses. Quantitative methods can be used to verify, which of such hypotheses are true. Quantitative research involves a collection of numerical data to answer a specific research question. Taking this definition one step further Christiansen goes on to note that quantitative research is a descriptive type of research where the goal is to attempt to provide an accurate description or picture of a particular situation or phenomenon.

Quantitative research methods are based on the idea that social phenomena can be quantified, measured and expressed numerically. The information about a social phenomenon is expressed in numeric terms that can be analysed by statistical methods. The observations can be directly numeric information or can be classified into numeric variables. Observations are transformed into a data matrix in which each observation unit (e.g. individual) occupies one row and each variable one column. The data matrix is the starting point for the analysis.

Some of the different types of Quantitative Research Methods used in information systems are:

Descriptive: descriptive research involves collecting data in order to test hypotheses or answer questions concerning the current status of the subjects of the study. It determines and reports the way things are.

Correlational: correlational research attempts to determine whether and to what degree a relationship exists between two or more quantifiable variables. However, it never establishes a cause-effect relationship. The relationship is expressed by correlation coefficient, which is a number between ”00 and 1.00”.

Cause-comparative: causal-comparative research: establishes the cause-effect relationship, compares the relationship, but the cause is not manipulated, such as "gender."

Experimental: experimental research establishes the cause-effect relationship and does the comparison, but the cause is manipulated. The cause, independent variable makes the difference. The effect, dependent variable is dependent on the independent variable.

3.6 Primary Research and Secondary Research

Primary research and secondary research are two terms that are to be understood differently due to the fact that they differ in their concepts and methods. One of the major differences between primary and secondary research is that primary research is conducted with the help of the primary sources available whereas secondary research is conducted on the basis of some data collected from someone who had got it from some source.

Let us take an example to point out the difference between primary research and secondary research. Interviewing someone is primary data and it would lead to conducting primary research because of the fact that you conduct the research from the source itself. Imagine you have written a book based on the interview that you have conducted. If somebody uses the book to prepare or write a report then the data available to that person should be considered secondary in purpose and the research conducted by him based on the book can be called secondary research.

It is interesting to note that primary research is expensive to conduct since it involves primary sources. On the other hand secondary research is not expensive to conduct since it does not involve the primary sources.

Another important difference between primary and secondary research is that the time taken to conduct primary research is usually long when compared to the time taken to conduct a secondary research.

As a matter of fact the results found from the conduct of primary research are usually known to have better quality than those found from the conduct of the secondary research. This is probably one of the reasons why people would like to depend more on the findings of a primary research rather than on the results of a secondary research.

Primary research is also usually detailed and elaborate since it is supposed to be both qualitative and quantitative in purpose. On the other hand the data pertaining to secondary research is usually not very much detailed and elaborate since it involves the indirect sources.

Primary research consists in research to collect original primary data. It is often undertaken after the researcher has gained some insight into the issue by collecting secondary data. This can be through numerous forms, including questionnaires, direct observation and telephone interviews amongst others. The term primary research is widely used in academic research, market research and competitive intelligence.

Secondary research (also known as desk research) involves the summary, collation and/or synthesis of existing research rather than primary research, where data is collected from, for example, research subjects or experiments. The term is widely used in medical research and in market research. The principal methodology in medical secondary research is the systematic review, commonly using meta-analytic statistical techniques, although other methods of synthesis, like realist reviews and meta-narrative reviews, have been developed in recent years. Such secondary research uses the primary research of others typically in the form of research publications and reports.

In a market research context, secondary research is taken to include the re-use by a second party of any data collected by a first party or parties. In archaeology and landscape history, desk research

is contrasted with fieldwork. Sometimes secondary research is required in the preliminary stages of research to determine what is known already and what new data are required, or to inform research design. At other times, it may be the only research technique used.

A key performance area in secondary research is the full citation of original sources, usually in the form of a complete listing or annotated listing. Secondary sources could include previous research reports, newspaper, magazine and journal content, and government and NGO statistics.

Finally it is true that secondary research is normally presented with varied data than primary research. But the secondary data has been well tested and the research paper has gone through the review process and its finding validated before appearing in research journals and publications. Primary research is done with lot of hard work and dedication. On the other hand secondary research is presented normally with a number of data and sources. These sources that are available already include books, periodicals published by governmental organizations, statistical data, annual reports, case studies and the like.

3.7 Research Method Used

After deciding to use the qualitative research methodology for this research, it was obvious from the onset that one of the qualitative research methods would best answer the research question to solve the research problem. Research methods prescribe the data collection technique and the instruments that would be used to analyse the data collected for reaching a conclusion to the problem. To decide on the research method to use in this research, the following questions were evaluated and answered:

1. **What exactly are you trying to find out?**

I am trying to investigate the opportunities and issues of cloud computing for developing countries. To fill this knowledge gap, information was required to be collated, analysed, and conclusions drawn. What I was trying to find out could be best answered by collecting qualitative data in the form of research papers and journal articles with the qualitative research methodology. This will involve the qualitative research method as it concerns literature and data collected from research papers and journal articles, as well as anecdotal evidence collected by other researchers on the same topic. **Document analysis** is the most common research method for such an endeavour.

Therefore the qualitative research method suitable for this type of research would be the combination of the **case study research method** and **grounded theory method**. Case study research generally answers one or more questions which begin with "how" or "why." The questions are targeted to a limited number of events or conditions and their inter-relationships. Grounded theory approaches are becoming increasingly common in the IS research literature because the method is extremely useful in developing context-based, process-oriented descriptions and explanations of the phenomenon (Myers, 2009).

2. What type of data [information] was being collected and the means of obtaining the information [data];

The data, which is in the form of information will be collected from research papers, journal articles, web sites, and web blogs using the Internet. The data collected in the form of information is textual, and thus can be analysed using the qualitative research methodology. As I would not be able to travel to developing countries to collect data, thus the means of obtaining data would be via the **Internet** and predominantly **secondary data**.

This will be a secondary research as I would not be able to collect raw data from all developing countries. Secondary research has been done to analyse data from existing journal articles and publications on the topic. Also, there is no need for primary research as there has been a lot of research and publication on this topic. Since it involves opportunities and issues from a developing country context, I might be in an ideal position to provide a primary participants perspective as being a developing country citizen. As pointed out by Argyrous (2009), “secondary data are an abundant resource for the policy researcher” as the Internet has made vast amount of data available. He also lists the advantages of savings on cost and time, access to quality data that has been tested, access to difficult populations and availability of longitudinal data.

This has been achieved with a comprehensive literature review and the following up on a multitude of ongoing research and conferences on the topic. The researcher has read extensively on the topic and contributes on conference panel of the same topic. The researcher did not see a need for primary research as there has been a number of researchers that have collected data regarding the same, but in different context. The researcher is able to use the existing data for analysis and conclude his research objectives.

3. The format in which the research findings will be reported

To answer the research questions, percentages and statistics could not be used as research was asking “how” and “what” questions which needed descriptive answer in textual format, and thus the use qualitative research method was required. We could say that the usage of mobile cloud computing will increase by 100% in the next 5 years using quantitative research methodology. But that is not good enough. We want to know “why” and “how”, we want to know more, we want to know everything possible – that is the reason for doing research, “**to know as much as possible”**. Qualitative research method is the key to know as much as possible.

Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. The case study method has been used to gain an insight on existing literature on cloud computing for developing countries. To assist in targeting and formulating the questions, researchers conduct a literature review. This review establishes what research has been previously conducted and leads to refined, insightful questions about the problem.

Finally, grounded theory has been used to conclude that there are potential opportunities and significant issues of using cloud computing with mobile phones for developing countries. Grounded theory is a research method that operates almost in a reverse fashion from traditional research and at first may appear to be in contradiction to the scientific method.

Descriptive methods will report the findings of this research. Descriptive methods enable researchers to observe and describe behaviours without investigating the relation between Specific variables of cause and effect. Descriptive research methods include: observational, archival, case studies, and focus groups.

A case study is a qualitative research method which involves a detailed examination of the actual experiences of a real-life subject, which may be an organisation, community, entity, programme, or person. The strength of case study research is that it can help us to understand more completely a complex situation or issue. A case study may shed light on a new situation or add evidence to knowledge discovered through previous research.

Case study research can be combined with the Grounded Theory Methodology (GTM) to build a theory (Eisenhardt 1989). Grounded Theory is derived from sociological research and was introduced by Glaser and Strauss (1967). GTM is described as the discovery of theory from data systematically obtained from social research‘(Glaser and Strauss 1967, p.2). There are a number of strengths with using the GTM. Firstly, the GTM is able to be applied to emerging research areas where there is little theoretical understanding. Secondly, the GTM forces the researcher to keep an open mind as they undertake the research processes of coding and forming categories. Most importantly, the findings that form the final substantive theory of the phenomenon being studied are grounded in the empirical data. GTM is appropriate for information systems research (Lehmann 2001; Lehmann and Fernandez 2007; Levina 2005; Orlikowski and Iacono 2001).

Grounded Theory Methodology

Glaser (1998) is clear in making sure that those wishing to use GTM as their research methodology should be aware that GTM is a specialised methodology that sets out to develop a set of integrated conceptual hypotheses rather than findings. Moreover, Glaser (1998) explains that GTM is the development of relationships between concepts. However, he points out those descriptive findings do play a role; once a theory is generated, it is a theory that has been generated by the conceptual description of the research findings (Glaser 1998).

The most vital aspect of GTM is to ensure that the theory generated is truly grounded in the findings of the substantive area, and that the researcher discovers the theory and does not force the data into preconceived ideas that they might have about the substantive area. Stating this more clearly, the data should not be forced into a theory; rather the data will produce a theory in good time by using the GTM in a rigorous manner. Glaser (2005) states that the full power of grounded theory comes with staying open to the emergent and to earned relevance throughout the whole GT methodology process (2005, p.1). GTM is a methodology that is based on the concept–indicator model where instances of concepts are derived from the data. GTM provides modes of conceptualisation for describing or explaining a particular phenomenon.

Case Study Research and Grounded Theory Method

Case study research is a common qualitative method used in IS research. Yin (2003) defines the scope of a case study as an empirical inquiry that investigates a contemporary phenomenon within

its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. A case study is a qualitative research method which involves a detailed examination of the actual experiences of a real-life subject, which may be an organisation, community, entity, programme, or person.

An examination of the literature demonstrates that similar interpretivist research, as that being undertaken in this thesis also uses interpretive case studies with the Grounded Theory Methodology (see Barrett and Walsham 1999; Levina 2005; Orlikowski and Iacono 2001; Trauth and Jessup 2000).