Basics of Research Design: A Guide to selecting appropriate research design

Bostley Muyembe Asenahabi
Kibabii University
asenahabibos@gmail.com

Abstract
For a research to be carried out successfully, it requires suitable research design. This is a plan adopted by a researcher before data collection commences so as to achieve the research objective in a valid way. The essence of research design is to translate a research problem into data for analysis so as to provide relevant answers to research questions at a minimum cost. This paper investigates what research design is, the different kinds of research design and how a researcher can choose the appropriate research design for his/her study. The study reveals that research design choice is guided by a careful analysis of statement of the problem, research questions, conceptual /theoretical framework and analyzing the relevant literature.

Keywords: Research design, Quantitative research, Qualitative research, Mixed method research

1. Introduction

Research is a careful and systematic way of solving problems and gaining new knowledge (Bhattacharyya, 2006; Thomas *et al*., 2011). Research can also be defined as being a systematic process of discovery and advancement of human knowledge. It should solve a problem or make an innovative contribution to the existing body of knowledge (Gratton & Jones, 2010; Kumar, 2008). For something to be counted as research, it has to be systematic and methodical in its approach and procedures and has to meet relevant norms and standards for validity and reliability.

Design is basically concerned with the aims, uses, purposes, intentions and plans within the practical constraint of location, time, money and the researcher's availability (Hakim, 2000). Research design is a reflection upon a researcher's ideas. It helps prevent frustration by binding the research together through a structure plan that show how all the major parts of the research work in unison to try to address the research questions.

An inquiry is categorized as a research if, as echoed by Jongbo (2014), it meets specific standards: it has to be based on a precise research problem and Specific Measurable Attainable Realistic Time-bound (S.M.A.R.T) objectives; it has to be informed in appropriate ways by theories and concepts; it must have appropriate data collection, organizing and analyzing techniques; it must offer an informed interpretation of results, and its findings must be consistent with the research question and implementation of the research design.

According to Creswell, (2014), researchers have to question themselves about the new knowledge and theoretical perspectives that they are bringing to any research. They must reflect upon the strategies they intend to use within their study which will in turn inform their methods. They also have to question themselves how they will collect and analyze information. Vogt *et al*., (2012) postulates that this must be done so that researchers have a perception of any bias that they might bring to any research investigation, how it will affect the choice of approach that they utilize and the tools with which they choose to collect their data.

The concept of research has to be understood by a researcher so as to understand which research methods and techniques to adopt, how to use them and where they will fit in the overall research process (Jongbo, 2014). A researcher requires sufficient knowledge of research design and its significance in research so as to overcome the challenges of selecting the research method and techniques to adopt in a research.

Basically, there are three distinct approaches to connecting research: quantitative, qualitative and mixed methods. This paper explains the concept of research design citing relevant studies on the basis of such crucial qualities so that a researcher can have a clear vision of what research design is, which one to adopt in a research and why.

2. Literature Review

Research design is the overall plan for connecting the conceptual research problems to the pertinent and achievable empirical research. It is an inquiry which provides specific direction for procedures in a research (Creswell, 2014). This is a step by step procedure which is adopted by a researcher before data collection and analysis process commences so as to

achieve the research objective in a valid way. The essence of research design is to translate a research problem into data for analysis so as to provide relevant answers to research questions at a minimum cost. Kerlinger, (1986) describes research design as a plan, structure and strategy of investigation that is adopted with an aim of obtaining answers to research questions with optimal control of variables.

Research design always determines the kinds of analysis that are to be done so as to get the desire results. It articulates what data is required, what methods are going to be used to collect and analyze the data and how it is going to answer the research questions. In line with this, Jongbo (2014) pinpoints that if a researcher collects data before thinking through the research design matters and what information is required to answer the research questions, the conclusions drawn will most likely be weak and unconvincing hence in the end fail to obtain the research objective. The research design must contain a strategy for interpreting the analysed data so as to provide adequate findings and conclusions from the research which will allow the researcher make recommendations or implications based on the study. Research design is divided into three groups: quantitative; qualitative and mixed method research design. The researcher has to decide the most appropriate design which befits the type of research work.

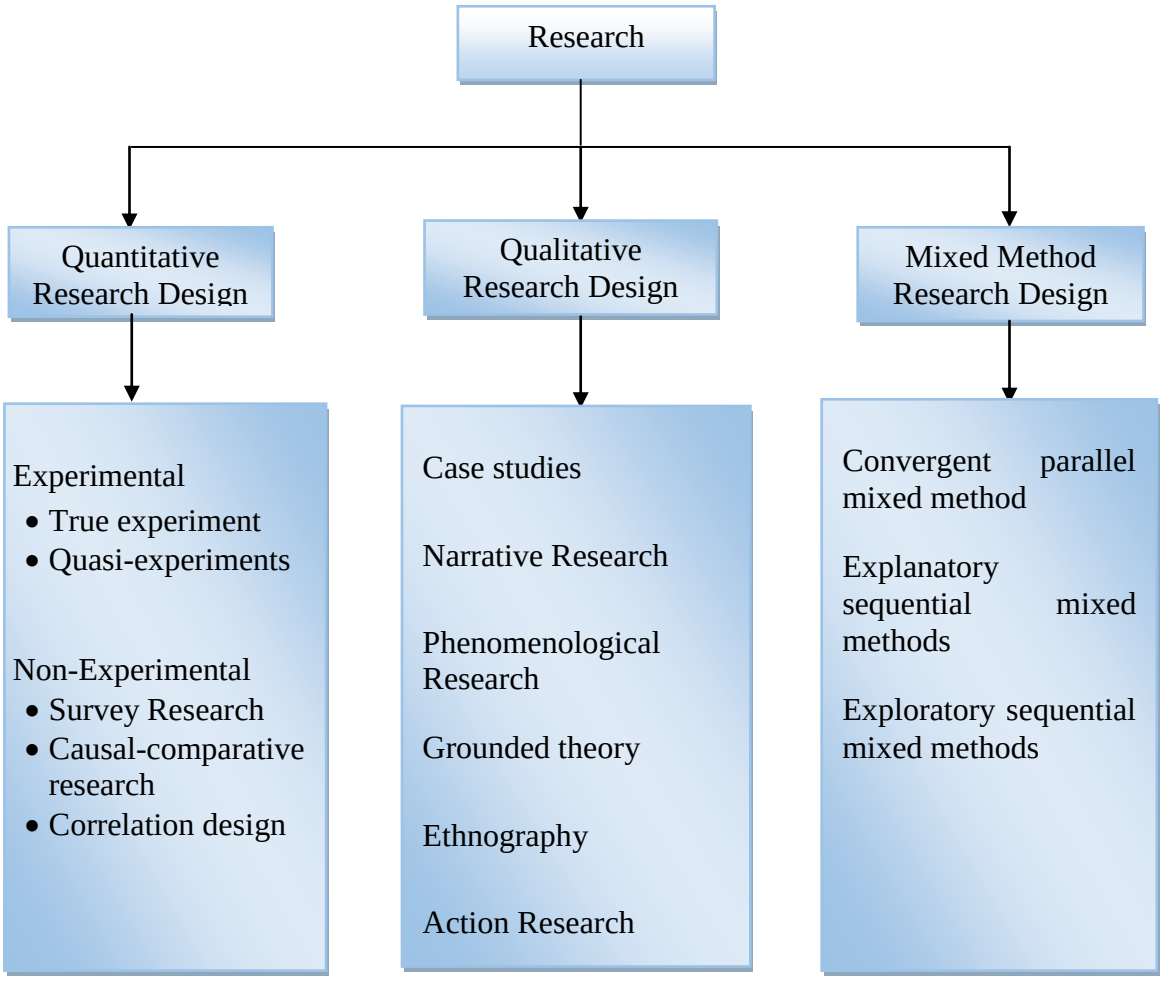

Figure 1: Summarized form of research design types.

2.1 Quantitative Research Design

Quantitative research design is the technique and measurements that produces quantifiable/discrete values (Kothari, 2007). The collected data results from empirical observations and measures. These methods require a good amount of time and planning. They always tend to have closed ended responses.

Quantitative reserch is considered as an analytical approach towards research. Quantitative researchers, as Rovai *et al*., (2014) elaborate, regard the world as being outside of themselves and there is an objective reality which is independent of any observations.

They further explain that for the purpose of research study, this objective reality is to be broken down into small manageable pieces which form the research objectives or hypothesis so that it can be understood. The relationships among variables in the objectives enable the researcher to generate data or test hypothesis through diffetent data collection methods. Conclusions can be drawn with respect to the objectives or hypothesis following a series of data analysis. The process of collecting and analyzing data is conducted applying mathematical and statistical methods which focus upon either experimental or non-experimental methods on collecting numeical data and generalizing the analyzed results to the study population. This method is based on postpositivist worldview (Phillips & Burbules, 2000). Quantitative research is divided into non-experimental research and experimental research designs.

2.1.1 Non-Experimental Design

Non-experimental design is basically quantitative research which does not involve experiments in the process of data collection. It is divided into three groups: Survey design; Causal-comparative design; Correlation design.

Survey Research

This type of research provides a numeric description of attitudes, opinions or trends of a population by studying a sample of that population. According to McNeill and Chapman, (2005) it is a method of obtaining large amounts of data, usually in a statistical form, from a large number of people in a relatively short time using closed-ended questions. Mugenda and Mugenda, (2003) point out that survey method is the process of collecting data from a sample group so as to determine the status of that group as per that time with respect to one or more variables. It is concerned with the present and attempts to determine the status of the phenomena being investigated (Singh, 2006). This method comes in handy when a researcher is studying several variables using a large sample size and rigorous statistical analysis (Sjøberg *et al*., 2007).

Survey research, as Jongbo, (2014) explains, involves a critical observation of events, objects, subjects and ideas without attempt to control the condition of such phenomenal. It describes a given state of affairs which exists at a particular time and requires a direct contact with individual whose characteristic, behaviours and attitudes are relevant to the investigation.

Survey research observations can be cross-sectional or longitudinal studies. Cross-sectional means the observations are done at one or more point in time while longitudinal study means the observations are carried out at different points in time. Cross sectional research design is descriptive, exploratory and explanatory while longitudinal survey focus on trend analysis cohort design and panel design (Jongbo, 2014). It either uses questionnaires or structured interviews for data collection with the intention of generalizing the sampled data to a population (Fowler, 2009). A variety of methods are available for administering surveys, however, the most popular are face-to-face, telephone, internet survey and mail. This is a good method to use to get data about what, why, how many (Mugenda & Mugenda, 2003).

It deals with questions that seek to find out about the nature of the target population and is best utilized when control of dependent and independent variables is not easily achievable or desirable (Wabwoba & Ikoha, 2011). It is instrumental when the sample has to be studied in its natural setting and occur in the current time or the recent past.

Survey research method can be further classified into: Descriptive survey (survey testing method, questionnaire survey method, Interview survey method); Analytical survey (Documentary frequency, Observational survey, Rating survey, Critical incident, Factor analysis); School survey and Genetic survey (Singh, 2006). School survey is an attempt to measure the effect of objective characteristics on human beings. It is concerned with both the objective aspects of an educational institutions including its administrative provisions and practices and the educational attainments of its pupils. The ultimate aim of all school surveys in educationalprogress which they achieve by focussing attention on unfulfilled needs or unrecognized evils of a school system on the one hand and on worthwhile practices on the other.

The principal advantage of survey studies is that they provide information on large groups of people, with very little effort, and in a cost-effective manner. Surveys allow researchers to assess a wider variety of behaviors and other phenomena than can be studied in a typical naturalisticobservation study (Marczyk *et al*., 2005).

The major drawbacks of survey design are: controlling against sample bias which can greately compromise generalization of the findings to the population; its dependency on the cooperation of the respondents which in the long run determines the degree of the results' reliability. Information that is not known by the respondents can hardly by unearthed and the information that is personal or secretive may easily be inaccurate (Wabwoba & Ikoha, 2011).

Causal-comparative/ ex-post facto research

Causal-comparative research is a type of non-experimental quantitative design where the researcher compares two groups or more. This comparison is performed with respect to a cause (which is the independent variable) which has already occurred (Creswell, 2014). Jongbo, (2014) attests that it is employed when there are two groups which differ on independent variable and the researcher wishes to investigate the difference of one or more dependent variables or difference of one or more independent variables.

Correlational research

Correlational research is a non-experimental quantitative design in which the researcher applies correlational statistics to measure and describe the degree of association among variables or sets of scores (Creswell., 2012). They attempt to find relationships between the characteristics of the respondents and their reported behaviors and opinions (Marczyk *et al*., 2005).

2.1.2 Experimental Research

Experimental research is the investigation where one or more dependent variables is manipulated to measure the effect on one or more variables. Jongbo, (2014) postulates that experimental research is based on cause-and-effect relationship on selected subject matter. It employs the use of two groups namely experimental and control groups where the experimental group is given treatment while the control group is not manipulated in order to establish the nature of relationship between the studied variables. In line with this, Sjøberg *et al.*, (2007) contend that experiments are performed where the researcher needs to have control over the situation with direct, precise and systematic manipulation of the behaviour of the phenomenon under study. This method is important in situations where testing of theories or hypothesis is at the centre of the study (Wabwoba & Ikoha, 2011).

There are different types of experimental designs: Pre-experimental designs is where the researcher studies a single group and provides an intervention during the experiment. In this case, there is no control group to compare with the experimental group. Quasi-experiments where the researcher uses control and experimental groups but does not randomly assign participants to groups. True experiment where the researcher randomly assigns the participants to treatment groups. Single-subject design which involves observing the behavior of a single individual or a small number of individuals over time. (Creswell, 2014).

One procedure to have control over experiments is using covariates for instance pretest scores as moderating variables and controlling for their effects statistically, selecting homogeneous samples, or blocking the participants into subgroups or categories and analyzing the impact of each subgroup on the outcome (Creswell, 2012).

2.2 Qualitative Research Design

Qualitative research emphasizes on exploring and understanding the meaning which a person or group of people ascribe to a social or human problem (Creswell, 2014). The historic origin for qualitative research comes from anthropology, sociology, the humanities and evaluation. Qualitative research design produces data that is not quantifiable using open-ended questions. This approach enables the researcher to comprehend issues by investigating them in their own specific context and the meaning that individuals bring to them (Denzin & Lincoln, 2005). Its main focus is to generate meaning, purpose or reality from opinions and experiences of participants (Merriam, 2009).

Qualitative research is usually inductive in nature and has several underlying assumptions: reality is a social construct; variables are difficult to measure, complex and interwoven; there

is a primacy of subject matter and data collected will consist of an insider's viewpoint (Rovai *et al*., 2014). This approach to research values individuality, culture and social justice hence providing a content and context rich breadth of information which despite being subjective in nature, it is current. The methods used to collect data under this design are basically interview, observation and participation.

Mugenda and Mugenda, (2003) attest that this enables the researcher to go beyond statistical results. This research method is based on constructivist worldview (Lincoln *et al*., 2011).

2.2.1 Case Study

Case study is a design of inquiry in which a researcher creates an in-depth analysis of a case which entail a process, animal, person, household, organization, group, industry, culture, or nationality. This is in line with (Sjøberg *et al*., 2007; Mugenda & Mugenda, 2003) who elaborate that it is an in-depth investigation of an individual, group, institution or phenomenon within its real life context especially where phenomena and context have a slim difference. Here depth means to explore all peculiarities of case. Case study is the intensive study of a phenomenon, but it gives subjective information rather than objective. It gives a detailed knowledge about the phenomena and not able to generalize beyond the knowledge (Singh, 2006). Singh goes on to explain that case study is an intensive investigation of the particular unit represented. It is bounded by time and activities. According to Woodside, (2010) case study is an inquiry that focuses on describing, understanding, predicting, and/or controlling the unit under study.

Case study gives a rigorous understanding of how and why certain phenomena occurs by revealing the mechanism by which a causal relationship occurs (Wabwoba & Ikoha, 2011). The researchers collects detailed information using a variety of data collection procedures and tools over a sustained period of time (Yin, 2012). Basically, a case study is out to determine factors and the relationships among them which led to the behavior being studied. It gives detailed information about the unit being studied. Case study technique studies the subject-matter qualitatively and covers all aspects of a single entity (Trochim *et al.*, 2015). It requires a considerable amount of information, and therefore conclusions are based on a much more detailed and comprehensive set of information (Marczyk *et al*., 2005).

This method has been criticized for relying on the researchers' interpretation which most likely leads to different interpretations over the same situation. The data collection process and analysis is also open to researcher bias (Wabwoba & Ikoha, 2011). Like all non-experimental approaches, they merely describe what occurred, but they cannot tell us why it occurred. The small number of individuals examined in these studies makes it unlikely that the findings will generalize to other people with similar issues or problems (Marczyk *et al*., 2005).

2.2.2 Narrative research

Narrative research is a design of inquiry from the humanities where by the researcher studies lives of individuals and asks them to provide stories about their lives (Riessman, 2008). The

information is then organized and retold by the researcher into a narrative chronology. Often, in the end, the narrative combines views from the participant's life with those of the researcher's life in a collaborative narrative (Clandinin & Connelly, 2000). The participants' stories are re-told by the researcher using structural devices, such as plot, setting, activities, climax and denouement.

2.2.3 Phenomenological Research

Phenomenological research is a design of inquiry which originates from philosophy and psychology where the researcher describes the lived experiences of individuals about a phenomenon as described by the participants.it is a qualitative strategy in which the researcher identifies the essence of human experiences about a phenomenon as described by participants in a study (Creswell, 2014). This description culminates in the essence of the experiences for several individuals who have all experienced the phenomenon. It uses the analysis of significant statements, the generation of meaning units, and the development of essence description (Moustakas, 1994). This design has strong philosophical underpinnings and typically involves conducting interviews (Giorgi, 2009)

2.2.4 Grounded theory

Grounded theory is a design of inquiry from sociology in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. This process involves using multiple stages of data collection and the refinement and interrelationship of categories of information (Charmaz, 2006; Corbin & Strauss, 2007). Grounded theory has systematic steps which involve generating categories of information (open coding), selecting one of the categories and positioning it within a theoretical model (axial coding), and then explicating a story from the interconnection of these categories (selective coding). This is a discovery method which allows the researcher to develop theoretical accounts which are based on concepts, categories and prepositions. It is used for developing theoretical framework for conceptualizing organizational issues around the adoption and use of Information Technology innovations and applications (Jabar *et al*., 2009). Jabar goes on to expound that the main undoing of this method is its sensitivity to the thoroughness and skills of researchers in interpreting data making it unfavorable for novice researchers.

2.2.5 Ethnography

Ethnography is a design of inquiry coming from anthropology and sociology in which the researcher studies the shared patterns of behaviors, language, and actions of an intact cultural group in a natural setting over a prolonged period of time. Data collection often involves observations and interviews (Creswell, 2014). Ethnographic research involves a rigorous description of the setting or individuals which is afterwards followed by analysis of the data for themes or issues (Wolcott, 1994).

Its goal is to study a community of people to understand how the members make sense of the social interactions. Ethnography as a design can be applicable in Information Technology where by the researchers can research on human, social and organizational aspects of

Information Technology innovations and applications for instance communities building a culture of practice and communication strategies to enable them to collaboratively use technology innovations (Sjøberg *et al*., 2007). Wabwoba and Ikoha, (2011) further explain that it is a powerful assessment of technology user's needs and allows for perceiving Information Technology innovations and applications in the eyes of the users.

Ethnography involves the researcher taking part, talking and doing things with participants in their real life situation for a long period of time. It is mainly carried out through observation over a period of time, (Mugenda & Mugenda, 2003) hence giving it a longitudinal perspective.

2.2.6 Action Research

Action research has for a long time been used to come up with an immediate and concrete solution to a problem in a local setting (Mugenda & Mugenda, 2003). It seeks to generate a solution to the problem at hand and is not concerned with whether the results can be generalized to any other setting. This research approach is of interest to scholars with an aim to intervene in the studied circumstances by developing an innovation to solve a problem in the society with little or no interest in generalization of the solution (Wabwoba & Ikoha, 2011). Sjøberg *et al*., (2007) clarify that it develops a solution that is of practical value to the people or organizations with whom the researcher is working with as it is an interactive process, yet it has minimal contribution to knowledge.

Despite the limited contribution it has for the body of knowledge, it is significant because it has the ability to provide answers to problems that can not wait for theoretical solutions. Its main weakness lies in its lack of objectivity on the researcher (Mugenda & Mugenda, 2003). This research approach also lacks control group and variables.

2.3 Mixed Methods research design

Mixed method research design is an integration of qualitative and quantitative research and data in a research study. According to Burke-Johnson *et al*., (2007) this is an empirical research in which a researcher combines elements of qualitative and quantitative research approaches for the broad purposes of breadth and depth of understanding and corroboration. Under mixed method research design, qualitative research brings in open-ended data without predetermined responses while quantitative research brings in closed-ended data (Creswell, 2014). Mixed method research design is based on pragmatic worldview (Tashakkori & Teddlie, 2010). This method was born out of the idea that both qualitative and quantitative designs have weaknesses, thus collecting both of them neutralized the weakness of the other. This approach leads to a greater degree of understanding being formulated unlike if a single approach is adopted to a specific study (Creswell & Plano-Clark, 2011). They further stated that a researcher collects and analyzes both qualitative and quantitative data in either sequential and/or simultaneous and the exhaustive manner in whichthe researcher integrates the two forms of data will depend upon the nature of the inquiry and the philosophical outlook of the researcher.

There are four distinct justifications for integrating quantitative and qualitative research data (Creswell & Plano-Clark, 2007): Triangulation design; Embedded design; Explanatory design and Exploratory design

Triangulation design

Figure 2: Triangulation mixed method design. Adopted from Creswell and Plano-Clark, (2007).

Triangulation design which seeks to gather complimentary yet distinctly different data on the same topic which can then be integrated for analysis and interpretation. It provides opportunities for convergence and corroboration of results that are derived from different research methods. It makes intuitive sense to utilize different methods to gather information from different sources which work together as an efficient design.

Embedded design

Figure 3: Embedded mixed method design. Adopted from Creswell and Plano-Clark, (2007).

Embedded design where one method of enquiry is used in a supportive secondary role which enables researchers and readers to make sense of the study in its entirety. It seeks elaboration, supporting, enhancement, illustration, clarification of the results from one method using the results from the other method. It requires fewer resources and produces less data which makes it an easier option for researchers to tackle. This method is used in quantitative experimental designs where only a limited quantity of qualitative data is necessary.

Explanatory designs

Figure 4: Explanatory mixed method design. Adopted from Creswell and Plano-Clark, (2007).

Explanatory design is a two-stage which involves quantitative data being used as the basis on which to build and explain qualitative data. The quantitative data informs the qualitative data

selection process. In this case, the researcher can specifically collect data that is relevant to that specific research.

Exploratory design

Figure 5: Exploratory mixed methods design. Adopted from Creswell and Plano-Clark, (2007).

Exploratory design is a two stage design which involves qualitative data being used as a basis on which to build and explain quantitative data gathering process. The separate stages are easy to implement and the qualitative data is acceptable to quantitative researches.

There are three basic types of mixed method research: convergent parallel mixed methods; explanatory sequential mixed methods and exploratory sequential mixed methods.

2.3.1 Convergent parallel mixed methods

Convergent parallel mixed methods is a form of mixed methods design in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. In this design, the investigator typically collects both forms of data at roughly the same time and then integrates the information in the interpretation of the overall results. Contradictions or incongruent findings are explained or further probed in this design. Creswell, (2014) outlines that this is a mixed methods strategy in which a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm or disconfirm each other.

2.3.2 Explanatory sequential mixed methods

Explanatory sequential mixed methods is one in which the researcher first conducts quantitative research, analyzes the results and then builds on the results to explain them in more detail with qualitative research. It is considered explanatory because the initial quantitative data results are explained further with the qualitative data. It is considered sequential because the initial quantitative phase is followed by the qualitative phase. This type of design is popular in fields with a strong quantitative orientation (hence the project begins with quantitative research), but it presents challenges of identifying the quantitative results to further explore and the unequal sample sizes for each phase of the study. According to Creswell, (2014) this is a mixed methods strategy that involves a two-phase project in which the researcher collects quantitative data in the first phase, analyzes the results, and then uses the results to plan (or build into) the second, qualitative phase.

2.3.3 Exploratory sequential mixed methods

Exploratory sequential mixed methods is the reverse sequence from the explanatory sequential design. In the exploratory sequential approach the researcher first begins with a qualitative research phase and explores the views of participants. The data are then analyzed, and the information used to build into a second, quantitative phase. The qualitative phase may be used to build an instrument that best fits the sample under study, to identify appropriate instruments to use in the follow-up quantitative phase, or to specify variables that need to go into a follow-up quantitative study. Particular challenges to this design reside in focusing in on the appropriate qualitative findings to use and the sample selection for both phases of research. Creswell, (2014) explains that this is a mixed methods strategy that involves a two-phase project in which the researcher first collects qualitative data and then follows up or builds on this database with a second quantitative data collection and analysis.

2.4 Choosing the correct research design for a research

The essence of research design is to achieve the research objective clearly, objectively, precisely and economically, control extraneous variance and minimize errors.

A researcher is expected to identify an area of interest, analyze literature in that area and locate a research gap in that area. The research gap should be critically analyzed and be framed into research objectives anr research questions with researchable variables. A research design is build on a concisely framed statement of the problem, research questions and clear sense of the research purpose. The researcher needs to keep reading the relevant literature until he is confident of the research question and the kinds of theory and concepts that fit the research question. It also helps to make coherent and justifiable decisions about the kinds of data to collect and how to analyze it.

Having prior knowledge of the different types of research design and guidance by a careful analysis of research statement of the problem, research questions, conceptual /theoretical framework and analyzing the relevant literature, the researcher should be able to select the most appropriate and relevant research design.

A quality research design comes up with a plan which incooperates the research problem, research questions, data collection methods, organization and analysis techniques which form a strong evidence of answers to the research questions and even convince users to accept that the findings based upon them are reasonable inferences.

3.0 Conclusion

A good research design shields a researcher from frustration by binding the research work together through a plan that outlines how all the major parts of the research work together to address the research questions. The chances of success of research work is boosted when the initial part is correctly defined as a precise statement of goals and justification. After this, the sequential steps necessary for writing a research plan and then successfully executing the research work will be easier to identify and organize. The choice of reseach design for a research study should be based on the nature of research but not randomly picking without justifiable reasons.

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