**CHAPTER 4: RESEARCH METHODOLOGY**

**4.1 INTRODUCTION**

In Chapter 4, Research Methodology is discussed that will be used to solve the problem under study. How methodology is interpreting research questions is elucidate, in this section following topic are present.

1. The scope, objectives and the approach used to solve problem under study.
2. Used a scientific approach, to propose a solution of research problem.

**4.2 SCOPE**

Disaster recovery and Business Continuity Plan is a mature area of interest now a day. Each business; large or small needs a disaster recovery plan to overcome the impact of disasters, any hazard that prevail to any big disaster and business loss. While selecting and implementing a disaster recovery plan the parameters under consideration are;

* Security
* Reliability
* Performance
* Recovery Time Objective (RTO)
* Recovery Point Objective (RPO)
* Test Time Objective (TTO)
* Energy Conservation
* Services Access Mechanism, (SAM).
* Network Switching Cost (NSC)
* Network Workload
* Fault Detection and Correction.
* Network Elasticity.
* Quality of Service (QoS).

**The main points that are the part of this research study are;**

* This study has highlighted the disaster issues (Naturally or Manmade) on cloud computing in the perspective of Pakistan.
* This study has focused on presented a disaster recovery model having specific performance parameters (RPO, RTO, TTO, Security and cost).
* In this study, we have used cloud simulator or matlab to verify the results or analysis of performance in the perspective of Pakistan or specially focus the IT organizations of Pakistan, which used private cloud computing deployment model.

**4.3 OBJECTIVES**

The objective of this research work is to propose a disaster recovery model that is best suitable for private cloud computing environment specially focus the atmosphere of Pakistan. The security and confidentiality of data is the main concern due to which private cloud is established and there are this is main concerned faced by Pakistan. In case of any disaster, the main concern is the security and confidentiality of organizational data so it is not possible to upload the data and application software on any unreliable machine on public cloud. The existing disaster recovery plans are examine so that a better solution should be propose in the perspective of Pakistan. The main objective of this research work is to focus the disaster recovery issues in the latest situation faced by Pakistan.

**4.4 RESEARCH METHODOLOGY**

Research is an academic activity and as such the term research should used in a technical sense.

**According to Clifford Woody,** research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis.

**According to D. Slesinger and M. Stephenson** in the Encyclopedia of Social Sciences define research as “the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.”

**According to Creswell (2013)** research is a systematic inquiry, which mainly aims to investigate hypotheses or a research questions. The purpose for conducting a research is:

1. To suggest new interpretations of data
2. Poses new question for future and further research.
3. Findings facts and contribute knowledge.

Research is, thus, an original contribution to the existing stock of knowledge making for its advancement. Moreover, as it is the pursuit of truth with the help of study, observation, comparison and experiment.

In short, the search for knowledge through objective and systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analyzing the facts and reaching certain conclusions either in the form of solutions(s) towards the concerned problem or in certain generalizations for some theoretical formulation.

**4.4.1 RESEARCH APPROACH USED**

Research always originates it with at least one specific question about one phenomenon of interest in any field of study. Research methodology; is defined by Leedy & Ormrod (2001) as “the general approach the researcher takes in carrying out the research project”

There are three common approaches to conducting research used those are as follows:

1. Quantitative Method Approach
2. Qualitative Method Approach
3. Mixed Method Approach.

**4.4.1.1 Quantitative Method Approach / Research Methodology.**

* The quantitative approach is to respond to a research questions requiring on prior basis a numerical data always.

Quantitative research involves around the collection of data “raw facts and figures”, to obtained information can be quantify and subjected to statistical analysis or treatment in order to support or refuse about any opinion. “Alternate knowledge claims” (Creswell, 2003, p. 153)

In short, quantitative research generally focuses on measuring social reality and their recent outcomes. Quantitative research and questions are searching for quantities in something, to establish research numerically. Quantitative researchers view the world as reality that can be objectively determined with numeric data.

**4.4.1.2 Qualitative Method Approach / Research Methodology.**

* Qualitative research is a holistic approach that involves discovery. The qualitative approach; for research questions always-requiring textural data.

**(Creswell, 1994),**Qualitative research is also describe as an unfolding model that occurs in a natural setting that enables the researcher to develop a level of detail from high involvement in the actual experiences

**Leedy and Ormrod (2001)** alleged that qualitative research is less structured; in description because it formulates and builds new theories and objectives.

**(Creswell, 2003).**Qualitative research can also be describe, as an effective model that occurs in a natural setting that enables the researcher to develop a level of detail from being highly involved in the actual experiences.

**4.4.1.2 Mixed Approach / Research Methodology.**

* The mixed methods approach for research questions requiring both numerical and textural data always.

A mixed research involves the mixing of both quantitative and qualitative methods. The mixed approach involves strategies of inquiries like collecting data (either simultaneously or sequentially) to best understand research problem at their best. The data collection involves gathering both numeric information as well as textual information.

Moreover, study begins with a broad survey and then focuses on qualitative method, open-ended interviews to collect detailed views from the entire participants. There are three ways of mixing the data such as follows:

1. Merging the data,
2. Connecting the data
3. Embedding the data.

Though it is not enough to simply collect and analyze the data (both quantitative and qualitative) ;there is a need to be mix together, in order to form a complete picture of the problem then they do when standing alone

**After all comparative analysis of research approaches. The research approach that we have selected for this particular research work, is the qualitative research approach. The steps involved in our research process are present as follows;**

Identify the Problem

Literature Review

Select a Methodology

Implement the Methodology

Conclusion

Figure No 01 Research methodology procedures used in this paper

**In the first phase of this research activity,** we identify the research problem and its impact, cause of loss on real life. The importance of research question, its implications, its research scope and research objectives are defined in this step.

**The second phase of this research activity is,** to relate the research problem with existing literature. A comprehensive literature review is required as it is method of identification, evaluation and interpretation about problem, based upon the previous work using books, journals, international publications, online searching etc.

**Why literature review is important?** The answer of this question is to find gap in current research, to identify the future research areas, to summarize the existing indication regarding the research in unbiased way. The reason of literature review in this study was to find the current work about disaster recovery solutions for cloud computing and to find a better solution in the perspective of Pakistan.

Then there is a need to select a research methodology to answer the research problem or issue. The research methodology provides a better way to find a solution that can be proved scientifically. The parameters are chooses to narrow down the scope of the research problem.

**Finally,** the presented solution is implemented and verified by using (simulator or matlab), to validate the solution.

**The conclusion and recommendations** for future research is the last part of this research activity that opens new horizons for new researchers.

**4.5 SUMMARY**

In this chapter we discuss the research methodology that will be used to solve the said research problem under study.