CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

The contribution of this chapter is to discuss the research methodology used in the research work. This chapter starts with the explanation of research methodology adopted for this research work. Next this chapter explains the purpose of the method, relation of research question and the research method, Relation of components of the method. Further, this chapter extends to discuss the unit of analysis, participant selection, sample analysis, ensuring validity and reliability of collected samples and ends with summary and conclusion of research methodology.

4.2 Explanation of Research Methodology

To examine the main research problem – “How to improve and maintain consistently high level of accessibility throughout the E-Governance websites in India?”, this research started with the intention of investing the existing literature of the current status of Indian E-Governance websites accessibility, properties of websites, features that cause accessibility issues for people with disabilities, evaluation types, existing guidelines, metrics and evaluation tools and people’s needs in Indian E-Governance websites.

The main part of the research work started with understanding the levels of accessibility of selected Indian E-Governance websites and functions on those sites, based on the guidelines WCAG 1.0 and WCAG 2.0, for people with specific disabilities. Next, the E-Governance website managers and content developers study were conducted with a set of five scale likert questionnaires regarding how they made decisions regarding the implementation of E-Governance websites to gain greater understanding of accessibility for people with disabilities. Additionally this research work extends to address disabled people’s needs in E-Governance websites. For understanding disabled people’s needs, a set
of five scale likert questionnaires was prepared based on the principles of Operable, perceivable, Understandable, Robust and overall satisfaction of websites and samples were collected from people with disabilities by pretest and post test of nine E-Governance websites. Finally, based on the previous study findings this research work proposed a new AESD model and AAEM metric for developing, maintaining and ranking of accessible E-Governance websites in India.

To complete this research work, the steps in the research were:

**Step1.** Performed literature review of persons with various disabilities, properties of websites, features that cause accessibility issues for people with disabilities, evaluation types, existing guidelines, metrics and evaluation tools and people needs in Indian E-Governance websites, and accessibility of Indian E-Governance websites.

**Step2.** Analyzed findings of literature review and identify key issues.

**Step3.** Performed accessibility testing by freely available automatic evaluation tool AChecker, in-order to identify the accessibility problems and the existing guidelines are implemented.

**Step4.** Performed managers and content developers accessibility testing, to understand and find the accessibility issues that cause problems for people with disabilities.

**Step5.** Performed end-users accessibility testing, to understand how much the existing E-Governance websites are accessible for disabled people and the disabled people’s requirements on E-Governance websites.

**Step6.** Proposed a new development model “AESD” for Developing Accessible E-Governance websites by integrating the requirements identified in above mentioned studies.

**Step7.** Proposed a new metric (AAEM) for assessing and ranking the accessibility level of E-Governance websites.
**Step8.** Drawn conclusions and proposed recommendations for future work that are not addressed in this research work.

The methods of this research were intended to provide a detailed framework to improve and maintain a consistently high level of accessibility throughout the E-Governance websites. The method included different types of accessibility testing, involving automatic tool testing, expert testing and end-user testing. It involved end-users with different types of disabilities including age related disabilities. Most of the studies of accessibility of E-Governance that have been conducted so far have relied on simple evaluation techniques (i.e., automated software) that cannot evaluate accessibility beyond the programming of the site. Such tools cannot assess websites in terms of design or use for persons with disabilities or the ability of the site to interact with assistive technologies. This study took a more detailed approach by employing multi-method accessibility testing of E-Governance websites with persons with a range of different disabilities.

The methodology in this study included two approaches to collect samples, observation method and answer the research questionnaires.

**4.3 Purpose of Method**

This type of multi-method accessibility testing offers several important benefits to E-Governance. First, accessibility testing can be applied to E-Governance websites and individual pages as they are being developed as a means to guarantee that new websites and web pages will meet the needs of users when they are posted, rather than being tinkered with and corrected after they have been posted (Mahmud & Ramakrishnan 2012).

Second, accessibility testing can be applied to existing websites to improve the websites by testing to determine the ways in which they can be redesigned to better connect with users (Kuppusamy et al. 2012)

Third, accessibility testing would provide a means to incorporate the perspectives of populations whose input might not otherwise be taken into consideration in the development and implementation of E-Governance (Lazar et al. 2004).
Fourth, complying with accessibility principles will guarantee an improvement in the usability of websites for both users with disabilities and for all other users (Norman et al. 2012).

The purpose of the managers, content developers and end-user questionnaires is to provide a context for the accessibility testing, examining the disabled people needs on E-Governance websites, Managerial problems, training, feedback, etc… These two methods, particularly the managers and content developers questionnaires, were also important to the evaluation of the conceptual framework at the conclusion of the study.

4.4 Relation of Research Questions to Research Method

The goal of this study is how to improve and maintain a consistently high level of accessibility throughout the E-Governance websites and more successful E-Governance project development in India.

The main goal is achieved by following sub questions; the first and second research question was addressed through the method of accessibility testing by automatic evaluation tools. The third research questions was addressed by E-Governance website managers and content developer study. The fourth research question of understanding the internal organizational factors or external pressures, by which an E-Governance site is or is not accessible were also addressed by the managers and content developers accessibility testing.

The fifth research question “Are there users participation needed to develop accessible website?” were addressed by the end-user study method of accessibility testing. End-user study also address of what specific elements of E-Governance websites are accessible / inaccessible and for whom are they accessible/inaccessible. The sixth and seventh research questions were addressed by proposing a new development model “AESD” and “AAEM” metric for Developing Accessible E-Governance websites by integrating the requirements identified in above mentioned studies.
4.5 Relation of Components of Method

The components of the method in this study were designed to be complimentary and to provide the maximum amount of meaningful samples about the research topic. The methods of accessibility testing revealed a different component of the adoption of new model and metric.

The automated accessibility testing examined the viability of software in testing the programming of the sites in terms of compliance with WCAG 1.0 and WCAG 2.0 guidelines. Together, these methods of accessibility testing explored numerous aspects of accessibility on the selected Indian E-Governance websites.

The managers and content developers testing examined the internal and external factors of organization that affect the accessibility of E-Governance websites. The questionnaire’s study has been conducted by face to face and the questionnaires are given directly to the managers and content developers of the websites which were studied provided insight into government agency perspectives on and the process of decision-making related to the implementation of accessible E-Governance websites.

The end-user testing examined the actual experiences of users with disabilities interacting with the websites. The combination of the contextual information from the above mentioned three studies were used to frame a set of requirements. To satisfy the requirement and to develop accessible E-Governance websites the research proposes a road map and measurement metric.

4.6 Unit of Analysis

The units of analysis for this study were the E-Governance websites in India. The focus of accessibility research is on the technical product, which is the websites in the case of this research. These units of analysis were examined in terms of their levels of accessibility.

The accessibility testing of E-Governance websites by automatic evaluation tools were carried out in the Master of Computer Applications lab at Dr.M.G.R. Educational and
Research Institute University. The study is conducted in terms of compliance with the guidelines of WCAG 1.0 and WCAG 2.0, both generally and specifically for people with different kinds of disability.

The accessibility testing of E-Governance websites by managers and content developers study is conducted by face to face. The managers and content developers study is carried out by a set of five scale likert questionnaires and questionnaires were given to the participants of various E-Governance websites managers and content developers of Government Institutions located around Chennai the capital of Tamil Nadu.

The accessibility testing of E-Governance websites by end-user study is conducted by face-to-face setting. Face-to-face testing was necessary to ensure that the group of participants includes persons with a wide range of disabilities were represented in the study. The study was carried out by pretest and post test method. In pretest the questionnaire collects some basic Demographic and background Information about the participants. In the post test, the researcher provided a series of specific websites and specific tasks to be accomplished on those websites. The participants are requested to complete the post-test questionnaire after completing the task in the government websites. The questionnaires main focus on disabled people needs in E-Governance websites. So the questionnaire is framed in to four categories of WCAG 2.0 principles (Operable, Perceivable, Understandable and Robust) and overall satisfaction about the websites.

Having participants evaluate a number of different websites allowed for comparison between different features (Operable, Perceivable, Understandable, Robust and overall satisfaction) on websites to determine what types of website features are the most likely to have been made accessible and what are most likely to remain inaccessible.

Finally the proposed model’s validation purpose a set of five scale likert questionnaire was framed based on the model and questionnaires was given to the three groups of people. The first group consists of above mentioned E-Governance website managers; the second group consists of experts (designers, researchers) and the final group consists of academic specialists from Dr.M.G.R.Educational and Research Institute University, L.N.Govt College and Madras University.
4.7 Participant Selection

The population for this end-user study consisted of individuals with visual or mobility (i.e., neuro-motor) impairments. A population consisting of these specific disabilities was selected based on the fact that barriers to access on websites are most likely to affect users who have visual or mobility impairments (Faulkner 2003; Becker 2004; Subhash & Singh 2010; Freire 2012). According to the report of Khan (2005) 12 million people in India are blind and 28.5 million have a low vision that affects the use of computer displays, while nearly 6 million people have mobility impairments. It was hoped that these groups would provide significant insight into the current barriers to access on E-Governance websites.

The population of persons with disabilities in this study was limited to persons with visual or mobility impairments. Individuals with a range of disabilities, including visual impairments, auditory impairments, mobility impairments, cognitive impairments, and learning disabilities, can encounter accessibility problems with E-Governance sites. However, a study that attempted to account for all of these types of impairments would be impracticable, as finding enough participants with each type of disability would be very difficult, and simply would be far too expensive for the scope of a study of this sort.

The participants needed to have some basic experience with computers and minimal experience using the Internet to participate in the study. The population for this study was selected using purposeful sampling. Random sampling was necessary, as the participants in the study needed to have identified visual or mobility impairments to be a part of the study population.

The participants in each group had a range of disabilities to provide a variety of perspectives on the accessibility of the E-Governance sites examined in the study. In the visually impaired group, participant’s had impairments ranged from reduced vision (i.e., legally blind but still have usable vision, inability to focus, or double vision) to complete blindness. In the mobility-impaired group, participants had an even wider range of disabilities, including problems with lack of control of limbs, poor control of limbs, coordination problems, or physical loses.
For the managers and content developers questionnaires, there was no participant “selection” as questions were given to the managers and content developers directly. Multiple attempts were made to contact each of the managers and content developers. The samples were collected in this effort helped to reveal the agency perspectives on and decision-making processes related to website accessibility.

4.8 Data Analysis

The samples were collected from the different methods of accessibility testing were linked together to form a set of requirement specification for disabled people needs on E-Governance websites. The research study results from each method, each test, and each website are maintained in terms of the accessibility requirement. Doing this allowed for comparisons of results by types of method used, and websites tested. This approach of keeping samples also allowed for analyzing the samples in terms of aggregate findings by category of websites and by all websites tested.

These various ways to analyze the data facilitated assessing the data in terms of internal and external issues of E-Governance websites and the responses to the manager and content developers questionnaires by providing many different ways to compare the findings, representing what is actually being done, to the goals from the policy environment, representing an ideal of what should be done.

4.9 Ensuring Validity and Reliability of Collected Data

Several steps were taken to ensure that the sample was valid and reliable. Efforts were made to control the factors that affect the accessibility tests with the participants. To ensure that technological issues did not cause problems that interfered with the accessibility tests, the participants were thoroughly instructed and made familiar with E-Governance at the beginning of each session. With the automated, managers and content developers tests, no external factors were an issue.

Efforts were made to assess the consistency of the findings of each of the methods of accessibility tests. The samples from each of the methods of accessibility tests were compared for consistency. The research finding from each individual participant for
internal consistency was assessed by Cronbach’s alpha test, so problems with internal validity were limited. Since the testing was not designed to occur over a long period of time, maturation, historical issues, and experimental mortality was not a concern. Participants did not engage in the activity more than once, so maturation, mortality, regression to the mean, testing, and instrumentation were not significant issues.

Threats to validity were limited. Participants were aware of what they were doing, but it was not an issue, as understanding what is being tested would not make a feature on a website accessible if it is not otherwise. To promote validity, the design and instruments were examined for appropriateness by experts on disability and on website accessibility prior to the conducting of the experiment.

As an important support of reliability, the respondents all were competent to participate in the experiment. Each participant had either visual impairment or mobility impairment, so each was qualified to assess accessibility in terms of his or her particular disability. The participants were, through their life experiences, accessibility experts in the most practical sense. Additionally Cronbach’s alpha test was conducted to find internal level of consistency and the reliability of collected data.

Issues of validity and reliability, within the parameters noted above, were addressed in terms of the following specific criterion:

- **Construct validity** – Accessibility was clearly defined and measured by the WCAG guidelines.
- **Face validity** – Outside researchers and programmers with expertise in accessibility evaluated study instruments.
- **Internal validity** – Data provided by different tests within same method (i.e., multiple user tests of the same website) produced consistent results.
- **External validity** – Findings were generalized only within parameters of data.
- **Reliability** – Cronbach’s alpha test carried out, different methods revealed similar data about tested websites.
To promote validity and reliability, these criteria were re-evaluated through the course of the study and at the conclusion of data collection.

4.10 Summary and Conclusion

The methodology employed in this study was intended to produce a detailed assessment of the accessibility of E-Governance websites in India. All of these different strands of related samples were combined to create a thorough portrayal of the accessibility of E-Governance websites.

Once the samples had been collected, this study was able to evaluate the levels at which persons with these disabilities are able to participate in E-Governance, the particular elements of E-Governance in which they are able to participate (i.e. what kinds of disabilities the websites are accessible for, the types of services that are accessible, and the kinds of websites that offer accessibility features) and the implications of the levels of access on the participation of persons with disabilities in E-Governance.

The combination of testing methods is intended to provide a comprehensive means by which to assess accessibility. Further, the findings regarding the various methods of testing may demonstrate how one or more might be used individually for specific purposes when assessing levels of accessibility on E-Governance websites.

Drawing upon the findings of the accessibility will help to establish accessibility best practices that can be used to assess, improve and maintain the level of accessibility on E-Governance websites in India. The next chapter describes about the accessibility testing of E-Governance websites by Automatic evaluation tool’s perspective.