

Chapter 2

Research Methodology

Abstract In this chapter, the multi-method research approach is adopted in order to achieve the research objectives: (a) methodological contribution for assessing V&A in a riverine flood prone case study area; (b) failed effect of adaptation i.e. economic consequences on farmers' households. Various kinds of research techniques are involved with the multi-method research approach, these are: structured questionnaire survey for understanding farmers' economic consequences of flooding within the socio-economic, demographic and environmental characteristics of farmers at household level; Participatory Rapid Appraisals (PRAs) for evaluating V&A scenarios and their importance in V&A assessment. An in-depth case study, field observation, literature review and professional judgment contribute to the understanding of the autonomous cropping adjustment processes of farmers in response to bio-physical interactions with flooding and flood research scenarios in Bangladesh from 1980 to 2014. Some key methodological issues are discussed in this chapter. The issues are: reasons for choosing a case study approach for understanding V&A assessment, an overview of the epistemological debate about qualitative and quantitative paradigms, procedures of appropriate sampling in V&A assessment, how and why to conduct a structured questionnaire survey in the flood-prone case study area, appropriateness of uses of PRAs and their advantages and disadvantages, and recent advancements in V&A assessment. This chapter concludes by describing how V&A issues in a vulnerable case study area can be identified, weighted and categorized in accordance with vulnerable farmers' opinions through PRA sessions.

2.1 Introduction

In this book a multi-method research approach has been applied to a case study. This chapter deals with the advantages and disadvantages of a case study approach and at the same time explains why a case study has been chosen for this research. According to the literature, there are strong epistemological divisions between

qualitative and quantitative approaches and their application in research work. In this research, a quantitative approach using a questionnaire survey and a qualitative approach using the Participatory Rapid Appraisal (PRA) method, in depth case study, and group discussions with farmers and block supervisors have been adopted. The PRA method is discussed in detail in Sect. 2.7 of this chapter.

The methodologist is concerned primarily with the logic of explanation, with ensuring that the arguments are rigorous, that the inferences are reasonable and that the method is internally coherent [1, p. 6]. The methodologist, therefore, is concerned with ‘the logic of justification’. Hammersley [2] argues that rather than being derived from philosophical or methodological commitments, the choice of method should be based on the goals and circumstances of the research being pursued.

This chapter focuses on the field research methods used because the collection of information on vulnerable farmers and their responses to natural hazards (such as flooding in Bangladesh) in places where there is extensive illiteracy and poverty poses some significant difficulties. As this study is more concerned with human response to hazard (how farmers adapt with flooding over time) rather than the physical attributes of floods, a mix of qualitative and quantitative methods was considered to be appropriate. In this sense the research methodology has links with what has been termed ‘multi-method’ research in the literature [3–5]. As [3, 5] note, multi-method research allows for both in-depth inquiry into particular cases (usually employing qualitative methods) as well as an examination of trends and characteristics over large populations which are often established using quantitative methods. A critical criterion of multi-method research is a linking of the qualitative and quantitative approaches in order to capitalize on the complementary strength of different methods of enquiry. Teddlie and Tashakkori [6, p. 15] suggests “*Mixed method research involves the collection or analysis of quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially and only the data is integrated at one or more stages in the process of the research*”.

2.2 Research Design

Whatever the research approach, all applied research has two major phases, planning and execution and four stages embedded within them. These are definition, design/plan, implementation and reporting or follow up [7].

Figure 2.1 illustrates the research design for this book and linkages with the research objectives. There are two broad objectives: firstly, to assess the failure effects of autonomous crop adaptation, that is, the economic analysis and consequences of EFEs, which has been achieved by the questionnaire survey in the case study area. This questionnaire survey flow is shown in Fig. 2.1. It starts with a pilot (pre-test) survey followed by a questionnaire survey on vulnerable communities. The data analysis process is completed by coding, data validation,

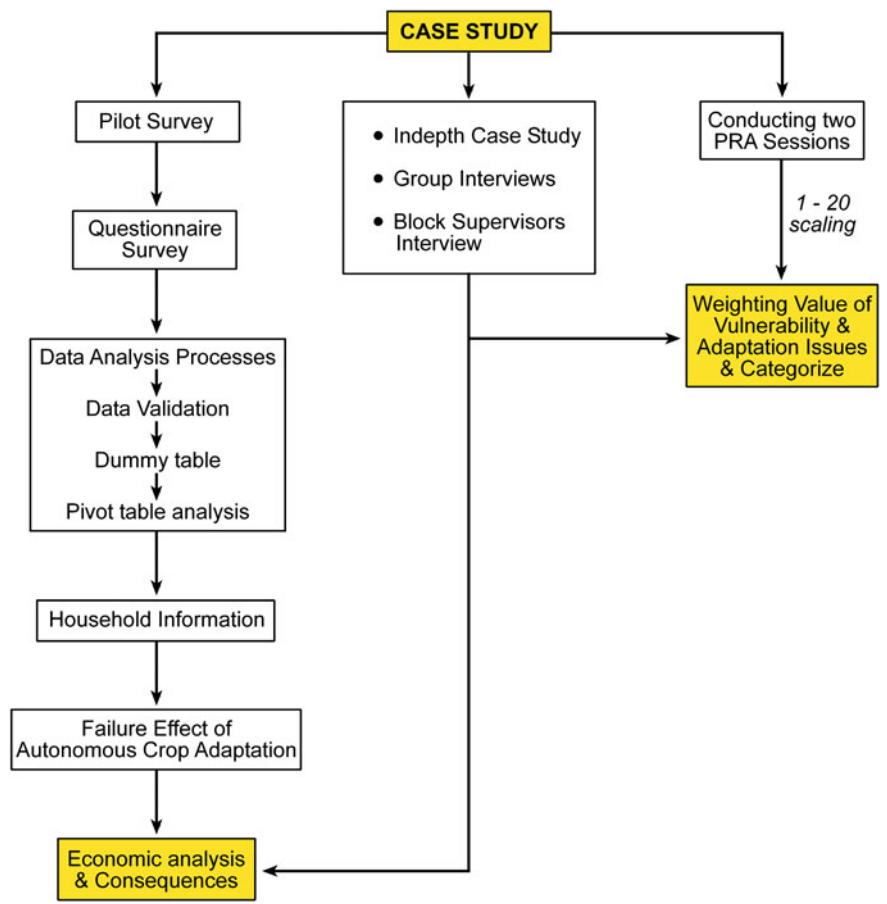


Fig. 2.1 Major findings and methodology used in the research

identifying the required dummy table, and manual analysis of the dummy table with the help of a pivot table analysis. The questionnaire survey provided two types of information, one is household information of vulnerable farmers and the other is the economic impact when the adaptation process fails. These two types of information determine the ultimate economic consequences.

Secondly, the research assesses V&A issues which are revealed by two PRAs. Both V&A issues are measured by a weighted index on a scale of 1–20 (Sect. 2.8).

Table 2.1 illustrates the broad objectives, methodology and respective category of research purpose for Chapters 3–7. The category of research purpose has been divided into three in accordance with research questions: exploratory, evaluative and interventional.

Table 2.1 Chapters with their broad objectives and respective methods used

Chapters	Broad objectives of the present research	Methodology used	Category of research purpose	Research questions
				What Why How
Chapter 3	To understand and review about the flood research in the context of Bangladesh	Literature review	Exploratory: to develop an initial rough description or, possibly, an understanding of some little understood and complex social phenomena	✓
Chapter 4	To understand farmers' household information in order to understand the socio-economic and demographic characteristics of marginal vulnerable farmers	Household survey through structured questionnaire in the case study area	Exploratory: initial understanding of socio economic and demographic phenomenon	✓
Chapter 5	To examine the autonomous cropping adjustment processes of farmers in response to bio-physical interactions with flooding, in order to understand the impact and severity of EFEs	PRA, field observations, group interview, in-depth interview	Evaluative: to monitor social intervention programs, and to assist with problem solving and contributing to policy making	✓
Chapter 6	To identify the V&A issues in response to EFEs in order to understand its importance in V&A assessment	PRA through weighted value index	Evaluative: to evaluate V&A issues and to assist with problem solving and policy making	✓
Chapter 7	To evaluate the economic consequences of the failure effects of autonomous adaptation in order to understand the future threat of human security in Bangladesh	Structured questionnaire survey	Intervention: to intervene in a social situation by manipulating some aspects of it, or by assisting the participants to do so, preferably on the basis of established understanding or explanation	✓

Adapted from Blaikie [8] and Yin [9]

2.3 Reasons for Choosing a Case Study Approach

The case study approach is being increasingly used in social science research. As described by Schramm [10], the essence of a case study is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented and with what result. Abercrombie et al. [11] discuss the case study approach in the *Dictionary of Sociology* as the detailed examination of a single example of a class of phenomena. A case study cannot provide reliable information about the broader class, but it may be useful in the preliminary stages of an investigation since it entails making a hypothesis, which may be tested systematically with a larger number of cases [12, p. 420]. Yin [9, p. 2] notes that the case study approach allows the investigators to retain the holistic and meaningful characteristic of real-life events. According to him the need to use a case study approach arises whenever an empirical inquiry must examine a contemporary phenomenon in its real life context, especially when the boundaries between the phenomenon and its context are not clearly evident [13]. Chetty [14] explains that the case study method of research is a rigorous methodology that allows decision making processes and causality to be studied. It is suitable when, why and how questions are asked about a set of events. McCutcheon and Meredith [15] argue that when properly conducted a case study is truly scientific despite being criticized as a weak form of research which lacks rigor and objectivity.

Benbasat et al. [16] defined case study research and noted that a case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities. He also identified eleven characteristics of a case study. Gable [17] presented an analysis of the benefits of integrating the case study and survey research methods. Flyvbjerg [18] described five misunderstandings about case study research and concluded that the case study is a necessary and sufficient method for certain important research tasks and it is a method that holds up well when compared to other methods in the gamut of social science research methodologies.

Platt [19] explained case study research in her historical American methodology thought as “*that which begins with a logic of design... a strategy to be preferred when circumstances and research problems are appropriate rather than an ideological commitment to be followed whatever the circumstances*” [19, p. 46]. The case study as a research strategy comprises an all-encompassing method, covering the logic of design, data collection techniques and specific approaches of data analysis. In this sense, the case study is neither a collection tactic nor merely a design feature alone [20] but a comprehensive research strategy [9, p. 14]. Majchrzac [21, p. 63] noted that case studies are advantageous in many respects as they ‘are usually quick, cost efficient and allow room for impressionistic analysis of a situation’. Case studies are frequently used in policy research as they offer the opportunity to examine the process of policy implementation and at the same time outline recommendations for future policy development and implementation. Yin [22, p. 254] focused on 4 steps that seem to

have been the most challenging in doing case study research: (step 1) defining and selecting the case(s) for a case study, (step 2) using multiple cases as part of the same case study, (step 3) strengthening the evidence used in a case study, (step 4) analyzing case study evidence.

In this study, one administrative unit, *Upazila*, Islampur, has been chosen as the case study area. This area is a riverine flood prone area which represents other riverine flood prone regions of Bangladesh. Two key objectives of this study are to assess V&A issues in response to EFEs and to assess the economic consequences of the failure effects of autonomous crop adaptation in the context of severe floods. To meet these objectives a case study area was required where farmers who are vulnerable to riverine floods and from whom household socioeconomic and demographic data can be obtained and compared with the failure effects of autonomous crop adaptation.

The author has chosen a case study approach for several reasons:

1. V&A issues which are being examined in this study can be easily explored by the case study approach.
2. Both qualitative and quantitative techniques can be used in the case study approach.
3. The case study approach is quick and explains realistic evidence in accordance with research questions.
4. The approach is cost effective and the required variables/information are easily obtainable.
5. Policy formulation and recommendations for development can easily be drawn from the obtained information.
6. It provides homogeneous information regarding flood vulnerability, adaptation and economic consequences.
7. It is an appropriate method to obtain and assess vulnerable farmers' opinions.
8. The case study approach represents phenomena likely to be found in other flood prone areas in this region.
9. The sampling and questionnaire survey method transforms primary information to secondary information.
10. The case study identifies holistic and meaningful characteristics of real-life events, for example, EFEs are the real life events that have been examined in this study.
11. The multi-method approach can be implemented in the case study method. For example, the questionnaire survey and the PRA methods have been effectively used in this case study.
12. The sampling was carried out in a broad case study area, for example, in Islampur *Upazila*, 14 *mauzas* from 7 *Unions* have been considered and compared. Two *Unions* were chosen for PRA sessions.

2.4 Overview of Qualitative and Quantitative Paradigms: An Epistemological Debate

The quantitative researcher isolates and defines variables and variable categories. These variables are linked together to frame hypotheses, often before the data are collected. In contrast, the qualitative researcher begins with defining very general concepts which, as the research progresses, change their definition. For the former, variables are the vehicles or means of the analysis while, for the latter, they may constitute the product or outcome. The qualitative researcher, searches for patterns of inter-relationships between a previously unspecified set of thoughts while looking through a wide lense, while on the contrary, the quantitative researcher seems to look through a narrow lens at a specified set of variables [23]. Crang [24, 25] explains how qualitative methods are now undergoing a period of more mature reflection and evaluation.

The second difference between qualitative and quantitative methods is the difference in data collection. In the qualitative method, researchers are involved as instruments, attending to their own cultural values and assumptions. It is important to achieve imaginative insights into the respondents' social worlds. To gain that, the investigator should be flexible and reflexive and at the same time maintain distance [26]. Participant observation is also an issue in this approach.

Qualitative techniques are usually applied where the research issue is less clear cut and the questions to the respondents are likely to result in complex and inconclusive answers. For example, participatory rapid appraisal (PRA) or in depth interviewing can be used as a qualitative technique. In this research PRA has been used in order to scrutinize the farmers' V&A assessment. By contrast, the quantitative method is much less flexible where the tool is predetermined and technologically tuned [23].

A quantitative method is appropriately applied where the research issue is clearly defined and the questions asked to respondents lead to concise answers. For example, a structured questionnaire survey has been used in this research in order to assess failure effects of autonomous crop adaptation. The method is developed based on the training and skill of researcher. Philip [27] has focused on the differences between qualitative and quantitative dualism and explained its subjectivity and objectivity. He also showed that there is both epistemological and methodological space for multiple method research.

Sale et al. [28] reached the conclusion that as the two paradigms do not study the same phenomena, qualitative and quantitative methods cannot be combined for cross validation purposes, but agreed that they can be combined for complementary purposes. Sandelowski [29] commented that the 'completeness' of any individual study, no matter what kind it is, must be judged without resorting to methodological fads or fetishes. Foss and Ellefsen [30] argued that the various methods used should be recognized as springing from different epistemological traditions which, when combined, add new perspective to the phenomenon under investigation. Winchester [31] emphasized that interviews need to be performed in

a ‘realistic framework’. He argued that if that is feasible, there would be no requirement of questionnaire methods to provide an illusion of ‘academic respectability’. Firestone [32] argued that while rhetorically different, the results of the two methodologies can be complementary. Howe [33] spoke for a ‘collaborative attitude’ to research and emphasized that researchers need at least a rudimentary understanding of what alternative approaches can provide.

Brannen [23] has identified where qualitative and quantitative methods differ and overlap in logical terms, described below.

2.4.1 Analytic Induction Versus Enumerative Induction

Analytic induction is used in qualitative methods. In analytic induction, the researcher moves from the data to hypothesis formulation, testing and verification. It is theoretical in its aim rather than descriptive. Where a qualitative method is used in a case study, it is the testing of theory that is important rather than the issue of inference or generalizability [34, 35], cited by Brannen [23, p. 6]. Analytic hypotheses have been criticized as “unscientific”, and at times fail to combine inductive logic of enquiry [23]. Moreover, a lot of qualitative research is mainly descriptive. It is mostly used in ethnographic work. The steps adopted in analytic induction are:

1. A research problem which is initially roughly defined.
2. A concrete case is then inspected by the investigator and its essential features are abstracted [36, 37].
3. A working hypothetical explanation is then formulated in the context of the case.
4. Determination, case by case, whether the facts fit the case.
5. Reformulation of explanation or redefinition of the phenomenon if a case does not fit the facts.
6. Explanation is confirmed after successions of cases are examined and the hypotheses seem to fit the case on every occasion.
7. The process is continued until no more negative cases are found. Unsuccessful cases generate negative feedback [1, p. 34], leading to the possibility of redefinition or reformulation which the researcher may carry on testing.

By contrast, in enumerative induction studies many cases with similar characters are abstracted conceptually due to their generality. In conclusion, enumerative induction abstracts by generalizing whereas analytic induction generalizes by abstracting [23, p. 7].

The quantitative researcher does not always test a hypothesis and its goal is often descriptive. In contrast qualitative researchers do have ideas about what they expect to find or intend to look for, albeit not necessary ideas to which they are heavily committed before the data collection phase begins [23, p. 8]. Another important criterion is that qualitative research is often criticized for being ‘atheoretical’ but sometimes it becomes theory-dependent.

2.4.2 Generalization Versus Extrapolation

If the quantitative researcher is interested in causal explanations, it is also necessary to go beyond statistical correlation and issues of representativeness and to resort to theoretical thinking about the linkages between the two characteristics [38]. In qualitative research, which is not based on statistical samples, the concern is mainly replication of the findings in other similar cases or sets of conditions.

In cases where quantitative methods are used such as surveys, there is a need to generalize, so samples are random or representative. On the contrary as qualitative methods are used in non-statistical samples, sampling may be done on the basis of theoretical criteria. The selection of cases cannot be planned beforehand as the researcher is expected to redefine the criteria governing the choice of comparison groups as the analysis proceeds on a case by case basis [23].

2.4.3 Multi-method Research

Some researchers such as Burgess [39] prefer the term multiple research strategy. It refers to the use of diverse methods to deal with one research problem. Burgess [40] argues that the researcher should be flexible and should select method/methods warranted by the research problem under investigation.

Another term, ‘triangulation’, originally borrowed from psychological reporting [41] and further developed by Denzin [37], combines methods, data, theories and investigators. Many researchers worked on triangulation (e.g. [6, 42–54]; Mitchell [55]). The term in general means using more than one method of research, with the use of more than one type of data [56]. Triangulation represents varieties of data, investigators, theories and methods [57]. These four categories are as follows: (1) Data triangulation (2) Investigator triangulation (3) Theory triangulation (4) Methodological triangulation [57] (Table 2.2).

2.4.4 Combining Approaches/Mixed Methods

Different scholars have used different terms about integrating qualitative and quantitative approaches such as integrative, combined, blended, mixed methods, multi-method, and multi-strategy etc. The most accepted term across disciplines is mixed methods [58–63].

Sandelowski [64, p. 326] stated:

In one kind of mixed methods study, qualitative and quantitative entities are in mixed company with each other, while in other kinds, they are actually blended. In the first kind of mixed methods study, entities are associated with or linked to each other but retain their essential characters, metaphorically, apple juice and orange juice both are used, but they are never mixed together to produce a new kind of fruit juice.

Table 2.2 Different types of triangulation [23, 37]

Triangulation types	Types of approach	Comments
Multiple methods	Within method approach	Same method is used on several occasions
	Between method approach	Uses different methods in relation to same object of study
Multiple investigators	Partnership approach	Multi-disciplinary research is done in partnership or by team, each bringing different view points
	Team approach	
Multiple data sets	First approach	Can be derived from application of different methods
	Alternative approach	Can be derived by using same method in different/points/situations/settings/sources and or variety of contexts
Multiple theories		Uses multiple rather than simple perspectives in relation to the same set of objects

Tashakkori and Teddlie [65, p. 286] broadly defined the mixed method approach as research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of enquiry. A key concept in this definition is integration. Teddlie and Tashakkori [61] differentiated mixed methods into two: quasi-mixed and mixed methods. The quasi-mixed method is a predominantly quantitative or qualitative approach, involving two types of data, but with no serious integration. On the other hand, the mixed method uses two types of data or analysis, integrated in all stages.

Rossmann and Wilson [66] illustrated how qualitative and quantitative methods and the data they yield can be used together to enhance an understanding of complex social phenomena. Robins et al. [67] emphasized that a combination of methods provides more robust understanding of services but there has been little guidance on how to blend these methods to build on the strengths of their respective epistemologies. Bryman [68] distinguished between technical and epistemological levels of discussion in the literature dealing with the quantitative/qualitative distinction.

Darbyshire et al. [69] drew the conclusion that the multiple method approach is valuable and does not merely duplicate data but offers complementary insights and understanding that may be difficult to access through reliance on a single method of data collection. Johnson and Onwuegbuzie [59] described mixed method research as an eight step process and concluded that the key feature of mixed method research is its methodological pluralism which frequently results in superior research. Bryman [70] identified several barriers to the integration of qualitative and quantitative research and argued that there is still considerable uncertainty concerning what it means to integrate findings in mixed method research. Morgan [71] advocates a ‘pragmatic approach’ as a new guiding

paradigm in social science research methods, both as a basis for supporting work that combines qualitative and quantitative methods and as a way to redirect our attention to methodological rather than metaphysical concerns. McEvoy and Richards [72] examined some of the issues that arise when methods are combined and concluded that using both qualitative and quantitative approaches gave the enquiry a greater sense of balance and perspective.

Bryman [73] suggests that there is considerable value in examining both the rationales that are given for combining quantitative and qualitative research and the ways in which they are combined in practice.

Previously triangulation was the most frequent purpose for conducting mixed methods. Today, it is being used more for other purposes. The main strength of the mixed methods approach is that researchers can attempt to reconcile diversity by using this method [65]. Both probability sampling and purposive sampling are used to maximize inference quality and transferability in mixed method sampling techniques.

The multi-method research approach depends on the purpose and research questions and ideas involved. Research questions lead to sampling type and data collection procedures, steps for data analysis and ultimately the research inferences and policy/practice/recommendation/decisions. In other words, research questions can lead to the defining of the research objectives. To meet the objectives, research methods are developed. Depending on the research objectives, qualitative or quantitative methods are applied. When research deals with an objective that needs both primary and secondary data, a multi-method research technique is usually required. Once a multi-method research is completed, policy recommendations are drawn in accordance with research aims and hypotheses.

Multi-method research was chosen for this study because the focal point of the research involves a cascade of multiple objectives. Three main objectives of this research are: (a) to examine the autonomous cropping adjustment processes of farmers in the case study area; (b) to make a methodological contribution for assessing V&A; and (c) to evaluate the economic consequences of failure effects of autonomous adaptation. Each of these key issues led to different research questions about bio-physical environments and the human response. To answer the many interrelated questions, the multi-method approach essentially is needed to deal with the complexities of the primary issues. The main methodological questions are:

1. How can I identify V&A issues?
2. What are the flood adjustments and who is obliged to adjust?
3. How can I assess failure effects of autonomous adaptation?

While searching for these answers, vulnerable farmers undoubtedly become the centre point. Only vulnerable farmers can fully describe the V&A issues as they are the group of people who have to adjust to extreme floods, and they can best explain what would be the effect of failure of autonomous adaptation processes. So, for this study, vulnerable farmers within the case study area were the main source of information. The author had to look for the best method to pose these questions to them in order to bring out the most credible responses.

The first method applied by the author was the questionnaire survey. Some questions called for open ended responses and others were closed. The questionnaire survey was designed to reveal that if adjustment fails, which issues would be affected as a consequence. Only vulnerable farmers, from their real life experience, are able to convert these losses to monetary terms. The socio-economic and demographic characteristics, and the adaptation techniques used by them can easily be identified by the structured questionnaire survey.

Similarly, adaptation and vulnerability issues can be assessed and weighted from the response of affected farmers by using the participatory research. The participatory rapid appraisal method (PRA) was adopted for this research because through the participation of the farmers and other local professional groups within the case study area, PRA explores the answers to the key research questions mentioned above. Field observations, in depth one on one interviews and group interviews have been chosen as additional methods in this study to obtain and clarify the required information. Therefore, all these methods applied in this study, comprise the multi-method research.

2.5 Sampling the Research Respondents

Sampling is a very important issue in research as the respondents chosen have a significant impact on the results. The sample is the subset of people to whom the questionnaire is administered [74]. Sampling means selecting units (e.g., events, people, groups, settings, artifacts) in a manner that maximizes the researcher's ability to answer research questions that are forthcoming in a study [65, p. 715]. A sample is selected to represent the group of people or institutions that are the subject of the research.

Sampling can be of five subtypes: (1) Random sampling, (2) Systematic sampling, (3) Stratified sampling, (4) Cluster sampling, (5) Multistage sampling.

In this research, survey work was performed in seven *Unions* of Islampur *Upazila*. Islampur *Upazila* was chosen as a case study area because of its unique characteristics, being an agrarian system located in a dynamic biophysical region. It is a highly flood prone area and experiences flooding every year under normal circumstances. It comprises *char* land area which is susceptible to riverine erosion and sand deposition. It is an ideal place to study main land characteristics and *char* land characteristics at the same time. Most importantly the farming system, is well adapted to the variability of the annual flooding. The farmers have been adapting to the flood situation every year and their crop planting decisions are determined by the prevailing flood characteristics.

From each *Union* two *mauzas* were selected according to severity of vulnerability to flooding. Information was collected regarding number of households in each *mauza* and number of members in each household. Each alternate household was selected as a sample for the questionnaire survey. Thus a systematic sampling approach was administered for this study. In systematic sampling, there is equal

probability of sample selection when a random start that is less than or equal to the sampling interval is chosen, and every unit that falls at the start and at the interval from the start is selected [75]. The requirements for systematic sampling are lists of characteristics of the study population, for example, approximate count of study population (N), sample size (n), sampling interval, and random start. The advantage of systematic sampling is that it provides an even coverage of the population within the sampling frame [74, p. 93]. It is easy to administer in the field [75]. Another important issue is the sample size. Large sample size provides more representative estimates of population characteristics and yields more information to address the research problem [74]. At the same time a large sample means more time, effort and cost for conducting the survey work. It is to be noted that precision always increases with sample size, but the improvements in precision decrease at larger sample sizes [74]. The benefits of larger samples begin to level off at sample sizes of 150–200 [76]. For this study 140 households were chosen for questionnaire survey. Owing to time and budget constraints and because of the remote location of the study area, it was not feasible to increase the sample size.

2.5.1 Sampling for Chinaduli Union

A total of 125 household damage reports comprised of household structural damage and plant damage were considered in this study. Data were collected from an unpublished report compiled by the then local elected member of *Union Parishad* where random sampling had been used. The author calculated the failure effects of ACA including agricultural associated loss through the questionnaire survey. The numbers from the unpublished report (household damage plus plant damage related loss) were added to this (crop damage plus agriculture associated cost) to estimate the total flood related loss.

2.6 Structured Questionnaire Survey

In the questionnaire survey respondents filled out and returned to the researcher a self administered interview in which the questions and instructions were simple and complete so that the respondent could act as his or her own interviewer [77]. There are two key aspects to this. First, the researcher consciously controls the process of data collection with the goal of producing scientifically useful data. Second the researcher interacts with subjects to elicit their participation [78, p. 93].

The goal of survey research is to obtain information regarding the behaviour, attitude and characteristics of a population by using a standardized questionnaire or survey on a sample of individuals. This has been an important tool to address a wide range of issues including perception of risk from natural hazards. Survey research is particularly useful for eliciting people's attitudes and opinions about

socio-political and environmental issues [74]. Before embarking on a survey research it is important to have a clear understanding of the research objective, the key questions to be addressed, the people or institution that make up the target population and the geographical area or time period of interest [74]. These issues underpin how the survey is designed and administered. When Fowler and Mangione [79] looked at strategies for reducing interviewer effects on data, they concluded that question design was one of the most important means of minimizing interview effects on data [80].

Survey research promises high generalizability. A theory built and tested with survey data has a better known range of applicability as to subjects than one based upon non survey data [78]. One of the main advantages of survey research is economy. It yields the maximum number of facts or bits of data per research dollar [77]. Another advantage is that the respondents can think, consult with others and review records before answering which is usually inappropriate in an interview setting. Some researchers argue that it is the most useful way to gather information on sensitive issues. If the respondent is convinced that the questionnaire is anonymous, then he or she can freely report attitudes or behaviour without fear of reprisal or embarrassment [81].

Surveys usually rely upon either questionnaires or fixed-choice interviews. As a result, there is little room for the investigator to probe areas about which the respondents are unable or unwilling to respond accurately. Due to the absence of experimental control over supposed independent variables and the fact that most surveys are cross sectoral, the task of distinguishing correlations between variables from truly causal relationships are complicated in survey research [78]. One of the limitations of this kind of study is that the questionnaire should be brief, otherwise respondents will not take time to complete them. Dillman [82] reviewed the effect of questionnaire length on respondents and concluded that 11 pages or 125 questions was the limit beyond which the response rate fell off. Another drawback is that the researcher cannot probe or follow up on interesting leads which is possible in interviewing and particularly of significance in exploratory research [77]. Some researchers argue that interviews produce better data and are more likely to generate extreme answers compared to a questionnaire survey. Another potential problem with questionnaire studies is the risk that someone other than the selected respondent can complete the questionnaire. In questionnaire surveys, there is scope for the respondent to come back later to change his/her answers once the real intent of the study becomes clear to him/her. Thus questionnaire surveys are not suitable for studies where some form of deception is practiced, according to Chadwick et al. [77].

2.6.1 Questionnaire Survey in the Study Area

A Pilot Questionnaire survey/pre-test questionnaire survey was conducted before the main questionnaire survey. Fourteen questionnaires were carried out in fourteen *mauzas* under seven *Unions*. This pilot survey was carried out to find out

whether the questions in the structured questionnaire were realistic, acceptable and applicable to the vulnerable farmers. Minor changes were done to the questionnaire following the pilot questionnaire survey.

The questionnaire survey is a technique/method administered to collect primary data from the vulnerable case study area which in turn generates quantitative data through analysis. These quantitative data have been used as the main tool in this research.

To ascertain the failure effects of autonomous crop adaptation or economic damage, analysis in response to EFEs is derived from quantification of the responses from the structured questionnaires survey. V&A assessment issues have been categorized on the basis of the results of the questionnaire survey. Although the PRA method has been used widely in order to categorize and weight V&A issues, in the present research prime quantitative data/information were derived from the questionnaire survey. This questionnaire survey result has helped to determine the weighted value matrix in the light of professional judgment. So the structured questionnaire survey is used as the prime technique to clearly understand the following issues:

1. Vulnerable farmers' socio-economic and demographic status.
2. Flood severity.
3. Flood consequences.
4. Economic loss due to flooding.
5. Human responses to flood behaviour which can be cross checked with hydrological data/information.
6. Crop data and crop decisions.
7. Adaptation and vulnerability assessment issues.
8. Policy intervention related to V&A and also failure effects of flood crop adaptation.
9. Flood crop adjustment during 1988–1998 time periods.

Due to constraints of time, finance and funding of research assistants for surveying the questionnaires, the author selected seven *Unions* out of 12 *Unions* in Islampur *Upazila* (Fig. 2.2). The *Unions* along the Jamuna River, on the West of Islampur, were chosen because these are the most flood vulnerable areas within this region. The author selected 20 households from each of these seven *Unions*. Normally, each *Union* is divided into several *mauzas* and two *mauzas* per *Union* were selected in order to get a reasonable cross section of farmers. In each *mauzas* 10 systematic questionnaire surveys were done. As the homesteads were dispersed clustered (linear shapes beside *kacha* or unpaved roads) every alternate house was chosen for the survey work. The heads of the households were mostly selected as the respondent. Another criterion for selecting respondents was that they had to be farmers, whether cultivating owned land or leased landowners. The sample of 140 households from 7 *Unions* and 14 *mauzas* was considered adequate to represent the V&A scenario in this area given the above constraints. The *Unions* and *mauzas* selected were as in Table 2.3.

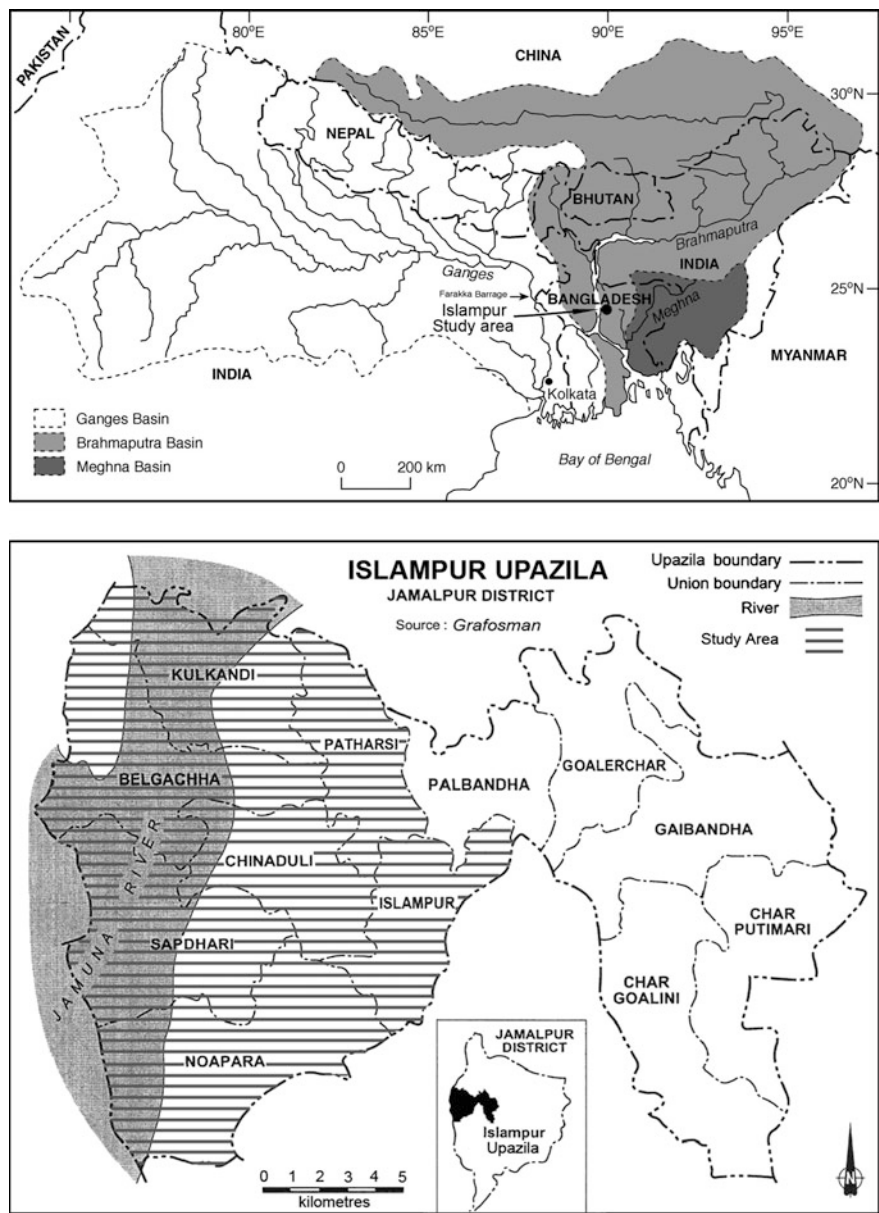


Fig. 2.2 The location of the Ganges, Brahmaputra and Meghna River Basin and the location of case study area (Islampur)

Table 2.3 Unions and selected Mauzas

Unions	Selected Mauzas
Kulkandi	Harindhara and Kulkandi
Sapdhari	Chengania and Shishua
Noapara	Maijbari and Kajla
Chinaduli	Gilabari and Bamna
Patharsi	Gamaria and Mukshimla
Islampur	Panchbaria and Pauchabahala
Belgacha	Dhantala and Belgacha

Four field assistants were employed to help with the survey work. All of them were interviewed before recruitment. They were from economics, geography, sociology and civil engineering backgrounds. The author chose them because of their background as this was meant to be a multidisciplinary study. Three of them were graduates of Dhaka University and the civil engineer a graduate from Bangladesh University of Engineering and Technology. They were all experienced with field survey study. They had to perform a field study while they submitted their thesis/project work during graduation. Among them the economist and the geographer were local, that is, from district Jamalpur, fluent in local dialect and jargon, which helped them to communicate appropriately with the local vulnerable farmers during the survey work. They were given instructions on the ethical rules and regulations about field questionnaire surveys. The field assistants had a good knowledge of social stratification in the context of rural areas in Bangladesh. In addition to helping the author with the questionnaire survey, they helped him with data coding.

2.6.2 Conducting a Questionnaire Survey in the Field

The author first trained the field assistants as to how to fill the questionnaire because the human response needed to be addressed and quantified systematically. They were first briefed about the characteristics of these three EFes, since the author had previous experience of the flood characteristics: timing, duration, frequency, depth and areal extent and how farmers cope or adjust with the flood events. Local farmers were well experienced with these flood events and they know every detail of each flood event and its biophysical interaction on agricultural land. When they were asked about a past flood event they spontaneously responded regarding V&A issues. For the first 3/4 days the author himself filled the questionnaire in the field assistants' presence to teach them how to do this. After that they were sent to remote areas to work independently. They were advised to ask for initials from the respondents once the questionnaire is filled in. It was noticed that most of the respondents were skeptical about signing the papers as they were mostly illiterate and unable to read what is written in the paperwork.

This is a very sensitive issue, particularly when asked to give their initials in paperwork where their income has been stated. For this reason the field assistants were asked not to force someone to sign the paperwork if they were not willing to do so, but their address was meticulously noted in the questionnaire. Sometimes they tend to exaggerate in the hope of getting ‘relief’ but when it was explained that this is for the purpose of study and appropriate information is needed, they usually co-operated and came up with original information. Each day, after completion of the questionnaires, the author and the field assistants came back to the rest house (*dak bungalow*) and after dinner, used to sit together and edit and check each questionnaire properly. If any confusion was raised, it was solved by discussion. Once all questionnaires were filled in, the field assistants signed at the end of each questionnaire for which they were responsible. The author examined each of them and countersigned accordingly.

It needs to be mentioned that all seven *Unions* are located in remote area where rickshaw and van are the main mode of transport, and the connecting roads are all mostly *kacha* (not paved) particularly Sapdhari, Noapara, Patharsi, Chinaduli and Kulkandi. The team members used to set out for the whole day after breakfast, and usually returned before sunset. The local UNO (*Upazila Nirbahi Officer*) briefed the team that because of the poor law and order situation, it would not be wise to work after dark in these *char* land areas.

The assistants were advised repeatedly regarding how to deal with the farmers who had just suffered significant losses and were still trying their best to cope with that. Because the flood was an extreme one, the farmers were very eager to get some form of assistance or relief from different agencies. Before we resumed the interviewing process, respondents were informed about the purposes of the research and why they and their area had been chosen. In the end the consent form was not used because the farmers, mostly illiterate, became very apprehensive when they were asked to sign a printed sheet of paper.

We commenced field work on 25th of September in 2006. The author visited all the *Unions* in order to conduct the survey work and for over all supervision. Local influential people such as chairmen, reputed school teachers and *Union parishad* members were contacted and their help in conducting the survey work was requested.

The structured questionnaire was fourteen pages long (Appendix I), so it demanded reasonable time for completion. For that reason the author was careful to ensure respondents had enough time to respond. In general the co-operation was good and genuine. Some of the farmers invited the author to visit their home, although in rural Bangladesh society people are very conservative. It helped the author to collect further socio-economic information—information that would assist in developing the framework for examining crop adjustment processes, weighting issues of V&A, and assessment of failure effects of autonomous crop adaptation in response to flooding.

At the end of the day, the author used to go through all the completed questionnaires with the assistants. When the author felt confident about the assistant’s capability to fill in questionnaires independently, then they were allowed to move

on to other sample areas separately. Once the survey work was completed in one *Union*, the field notes were taken from the assistants. The questionnaires were stored in a secure place.

2.7 Participatory Rapid Appraisal

2.7.1 *Rationale for Choosing Participatory Rapid Appraisal*

Before discussing PRA, we need to clarify what is participatory research. Breaking the linear mould of conventional research, participatory research focuses on a process of sequential reflection and action, carried out with and by local people rather than on them [83]. In recent years organizations ranging from small NGOs to UN agencies have been using participatory methods, and their use is on the rise [84]. Most participatory studies focus on knowledge for action, contrary to traditional research which usually generates knowledge for understanding [85, 86]. In conventional research, inappropriate recommendations have frequently followed from a failure to take account of local priorities, processes and perspectives [87, 88]. Participatory research focuses on a ‘bottom-up’ approach with emphasis on local priorities and perspective [89]. It is shown that involving local people as participants in research and planning enhances effectiveness and saves time and money [83, 90]. Pain [91] noted that some social geographers encourage students to experience participatory research.

Participatory rapid appraisal (PRA) is a form of rapid rural appraisal, a research technique developed in the late 1970s and early 1980s as an alternative or complement to conventional sample surveys. It ensures quick and systematic collection of information for general analysis, assessment, feasibility studies, identifying and prioritizing projects, project evaluation, participatory mapping and modeling, transect work, matrix scoring, weighted index and ranking, well-being grouping and ranking, seasonal calendars, trend and change analysis and analytical diagramming [92, 93]. Based on the work of Chambers [93] PRA flows from and owes much to the traditions and methods of participatory research [94], applied anthropology and field research on farming systems [95, 96] and has evolved most directly from a synthesis of agroecosystem analysis [97–99] and rapid rural appraisal [100–102]. In PRA most of the investigation, sharing and analysis is open-ended and often visual by groups of people and through comparison. Its purpose is more to gain an understanding of the complexities of a topic rather than to gather highly accurate statistics on a list of variables. The PRA method enquires about the population’s attitude, beliefs and behaviours and is applied most effectively in relatively homogeneous rural communities which share common knowledge, values and beliefs. In other words PRA is an interesting, systematic but semi-structured learning experience carried out in a community by a multi-disciplinary team which includes community members. It requires attitudes

favouring: participation, respect for community members, interest in what they know, say, do and patience, not rushing or interrupting, listening, not lecturing, humility and methods which empower community members to express, share, enhance and analyze their knowledge [92].

In the last 10 years, rapid appraisal techniques have gained widespread recognition in development research and are being increasingly used as a complement to conventional research work [92]. In the last 5 years participatory research such as rapid rural appraisal (RRA), participatory rapid rural appraisal (PRRA), rapid assessment procedures (RAP), participatory learning methods (PALM), and participatory rural appraisal have gained huge momentum [92].

PRA has spread through field learning experience, through workshops by villagers and through dissemination material [93].

Features of PRA [92] include: (a) Triangulation: a form of cross-checking. Triangulation is done in relation to sources of information, composition of the team and mix of techniques; (b) Multidisciplinary team; (c) Mix of techniques; (d) Flexibility and Informality; (e) In the community; (f) Optimal ignorance and appropriate imprecision; (g) On-the-spot analysis; (h) Offsetting biases and being self critical.

2.7.2 Advantages of PRA

Some researchers proclaim that PRA is the universal solution to the problems faced by conventional practice [103, 104]. Some participatory methods like participatory rural appraisal offer strategies for generating both qualitative and quantitative information [105]. Participatory methodologies are often characterized as being reflexive, flexible, and iterative whereas the conventional methodology is rigid and linear. [84, 103, 106]

Commonly used survey methods often take too long for data to be collected, analyzed, and disseminated to be useful to development workers and community members [92]. Participatory research ensures the participation of community members and community development workers in the process of information collection rather than giving all key responsibilities to outsiders and thus is intended to serve as a tool for community development activities [92].

It is a short duration and low cost method which enables conducting a series of PRAs rather than having to rely on the results of one large survey [92]. If we want to learn about community member's attitudes, behaviour and opinions then the best method would be PRA (Theis and Grandy [92], p. 32). PRA also raises people's self-awareness, suggests viable solutions, and helps people analyze complex issues and problems.

PRA approaches and methods present a plurality of methods with triangulation and cross checking; and local analysts are usually committed to getting detail,

complete and accurate information and can from their personal experience interpret change and causality [93].

PRA can be used as an alternative to conventional sample survey using questionnaires. It has been found to generate valid quantitative as well as qualitative data and also some good ratio estimates for some variables [93].

When well facilitated, PRAs are usually cheaper, quicker, more accurate and more insightful. For example in a 412 households study with a participatory wealth ranking approach in South India, the questionnaire cost seven times as much as PRA and took eight times as much staff time besides giving less valid results [107].

There is scope for local illiterate people to get involved as facilitator and trainers. It has been shown that they can map, model, rank, score, analyze and sketch a diagram, often better than the outsiders [93].

2.7.3 Disadvantages of PRA

Some have argued that a participatory approach is biased, impressionistic and unreliable [83]. There is the possibility that participatory research is being unnecessarily mixed up in the debate surrounding the qualitative-quantitative divide, with critics describing this method as soft [2], that is, insufficiently quantified.

The key element of participatory research lies not in the method but in the attitude of the researcher which in turn determines how, by whom and for whom research is conceptualized and conducted [83].

The practice of participatory research raises personal, political and professional challenges that go beyond the bounds of production of information [83].

Chambers [93] has identified four dangers associated with PRA:

1. Instant fashion: due to over rapid promotion and adoption followed by misuse, and because of sticking on labels without substance.
2. Rushing: Hurried rural visits, insensitivity to social context, and lack of commitment may mean that the poorest are neither seen, listened to nor learnt from. Pottier [108] found that hurried farmer interviews conducted in Zambia were erroneous. Similarly van Steijn [109] found that PRAs conducted in the Philippines were of low quality. So he came to the conclusion that rapid often means wrong.
3. Formalism: With any innovation, there is an urge to standardize and codify hence the rush to compose manuals. As the text lengthens, training is prolonged and more and more time spent in classroom and less and less in field practice which may lead to loss of spontaneity and learning may be slowed or even reversed.
4. Routinisation and ruts: practitioners in some organizations and regions have shown signs of slipping into unvarying standard practices, overlooking other options.

2.7.4 Summary: Spread and Characteristics of PRA

PRA is an internationally accepted qualitative survey technique which is widely used in different studies and international organizations such as World Bank, Action Aid, ILO, Aga Khan Foundation, Ford Foundation, GTZ, SIDA, UNICEF, UNDP and UNCHS (Habitat). Among many applications PRA has been used in natural resources management (community planning, fisheries, forestry, soil and water conservation), programs for women and the poor, agriculture, health and food security [93]. PRA has spread from Ethiopia to South Asia including Bangladesh, to at least forty Asian, African and Latin American countries. Hundreds of NGOs, Government departments, students and university staff have been using PRA methods for their research and action work [93] (Chambers [110]). It has some unique characteristics. Evidence of this was obtained by the author during his experience conducting two PRA sessions in the case study area; and other literature has supported this [83, 90, 93, 111–125] (Chambers [110]). These characteristics are listed below.

1. PRA is a short duration session which spreads knowledge and information rapidly among different people with varying occupations and economic groups.
2. Local information can be quickly collected by using this method.
3. It combines the knowledge of professionals/experts with the life experience of affected people.
4. Within the local/affected group of people, there are representatives from different social strata, religions, age groups and responsible local policy makers.
5. It has been developed for collaborating with local people in analysis and planning and has contributed to the development of action plans and participation strategies.
6. As a whole of community appraisal comes out of these sessions, country/national level policy makers attend these sessions as well.
7. It can transform qualitative data to quantitative data.
8. It helps in transferring the data to policy formation; the most important criterion of PRA is that it deals with qualitative information and transfers the knowledge into policy formation.
9. It emphasizes local knowledge, and enables local people to make their own appraisal, analysis, and plans.
10. The PRA technique uses group animation and facilitates information sharing with the stakeholders. Different strata of people: farmers, teachers, elected local public representatives, politicians, and students are involved as participants in this interviewing session.
11. It involves a bottom up research approach which transforms local information to national policy information.
12. It helps to assess scientific explanation routes, whether inductive or deductive. It enables information evaluation; if any confusion arises in the evaluation

process, it is possible to return to the initial planning process, such as problem identification and collect the information again and re-evaluate.

13. It enables the researchers to cross check information: the interlinked information can be cross checked as well.
14. It is a participatory approach, that is, it ensures the participation of local people in policy making without any third party involvement. If any controversy arises, information provided by a third party can be checked.
15. Semi structured questions are raised for consideration by the attending participants and they can respond to those.
16. As a consequence of discussion and debate between the participants the appropriate answers come out easily.
17. These answers can be ranked and weighted values can be given them in accordance with priority.
18. PRA evolved from a series of qualitative multidisciplinary approaches to learning about local-level conditions and local peoples' perspectives, including Rapid Rural Appraisal and Agrosystem Analysis.
19. PRA provides a "basket of techniques" from which those most appropriate for the project context can be selected. The techniques include interviews and discussions, mapping, ranking, and trend analysis.
20. PRA is cost and time effective compared with other methods used in social science such as structured questionnaire survey method.
21. The purpose of PRA is to enable development practitioners, government officials, and local people to work together to plan context appropriate programs. Within this session semi structured or specific questions are raised among the attending members; and they react to those. As a consequence the answers can easily come out; and later these can be ranked in order of the priority. No one among the participants can independently deliver wrong or misleading information. If someone wants to mislead then the majority react negatively and say that this information is wrong and at that time they also reveal the appropriate information along with the reasoning behind it. Through these processes we can get the right information and prioritize it.
22. It is an informal technique which helps to collect the local rural information quickly. The key tenets of PRA are: participation, questioning, teamwork, flexibility, 'optimal ignorance', and triangulation.

2.7.5 Differences Between RRA and PRA

Before we embark on a discussion about Participatory Rapid Appraisal (PRA) and Rapid Rural Appraisal (RRA) and their differences, it is important to know the differences between PRA and survey research, which are shown in Table 2.4. New research techniques such as RRA were developed in order to achieve a more comprehensive understanding of complex and highly uncertain and changing

Table 2.4 Differences between PRA and survey research

Issues	PRA	Survey research	Issues	PRA	Survey research
1. Duration	Short	Long	10. Major research tool	Semi-structured interview	Formal questionnaire
2. Cost	Low to medium	Medium to high	11. Sampling	Small size	Random, representative
3. Depth	Preliminary	Exhaustive	12. Statistical analysis	Little or none	Major part
4. Scope	Wide	limited	13. Individual case	important, weighted	Not important
5. Integration	Multidisciplinary	Weak	14. Formal questionnaires	Avoided	Not weighted
6. Structure	Flexible, informal	Fixed, formal	15. Organization	Non-hierarchical	Major part
7. Direction	Bottom-up	Top-down	16. Qualitative descriptions	Very important	Hierarchical
8. Participation	High	Low	17. Measurements	Qualitative or indicators used	Not as important as 'hard data'
9. Methods	Basket of tools	Standardized	18. Analysis	In the field and on the spot	Detailed, accurate
					At office

Source Theis and Grandy [92, p. 34]

Table 2.5 The comparison between PRA and RRA

Major issues	RRA	PRA
Period of major development	Late 1970s, 1980s	Late 1980s, 1990s
Major innovators based in	Universities	NGOs
Main users	Aid agencies Universities	NGOs, Government field organizations
Key resource earlier overlooked	Local people's knowledge	Local people's organizations
Main innovations	Methods	Behaviours
Predominant mode	Extractive-elicitive	Facilitating-participatory
Ideal objectives	Learning by outsiders	Empowerment by local people
Outcomes sought	Useful information, reports, plans, projects	Sustainable local action and institutions

Source Chambers [93]

societies and communities. RRA is the one of methods which deals with changing society and assesses vulnerability of environment. RRA is characterized by an applied, holistic, and flexible approach of progressive learning, conducted by multi-disciplinary teams which emphasizes community participation. RRA methods have been applied mainly in agricultural development, but now have widespread application in many different fields, for example, urban housing problems, health and medical geography and impact assessment of natural disasters [92].

Table 2.5 shows the differences between PRA and RRA. PRA and RRA share some of the same principles, such as direct learning from local people, offsetting biases, triangulating, seeking diversity and optimizing tradeoffs. One of the main differences between PRA and RRA is that RRA information is more easily elicited and extracted by outsiders, but in PRA it is more readily shared by local people [93].

The main differences between RRA and PRA are: in RRA the outsiders go to rural areas or case study areas, elicit and extract information from local people and then bring it back to analyze and process. The information collected is owned by the outsiders and usually not shared with the people from whom they obtained the information. On the other hand, in PRA, outsiders/professionals go to the rural/case study area in the same way but they facilitate rural people in collection, presentation and analysis of information by themselves. The information thus is owned by the local people but is often shared with the professionals/outside [123]. In other words, PRA empowers local people to assume an active role in analyzing their own living conditions, problems, and potentials in order to seek a change in their situation. These changes are supposed to be achieved by collective action and the local communities are invited to assume responsibility for implementing many, if not most of the actions.

PRA is a growing combination of approaches and methods that enable vulnerable people to share, enhance, and analyze their knowledge of life and

conditions, to plan and act and to monitor and evaluate (http://participation.110mb.com/PCD/PRA_Training/pcdptra/How%20to%20carry%20out.pdf). The role of the outsider is that of a catalyst, a facilitator of processes within a community which is prepared to alter their situation.

PRA was first developed in India and Kenya during the 1980s (Chambers [110]); it has been mainly used by nongovernmental organizations (NGOs) working at the grass-roots level. However, the principles and many of the approaches and methods are increasingly being used by such organizations as The World Bank, UNDP, ILO, among others.

RRA is an extractive research methodology consisting of systematic, semi-structured activities conducted on-site by a multi-disciplinary team which enables quick and efficient acquiring of new information about rural life and rural resources.

RRA emerged in the late 1970s. The purpose of RRA is to quickly collect, analyze, and evaluate information on rural conditions and local knowledge. In most cases RRA is carried out by a small team of researchers or trained professionals in 1–3 days in a kind of workshop. The information is elicited and extracted in close cooperation with the local people. As the method developed, the research methods had to be adapted to the needs of local people. They especially had to meet the communication needs of people who could not read and/or write or people who were not used to communicating in scientific terms. Several tools like mapping, diagramming, weighting and ranking were developed and activated to collect information for decision makers. It is extremely important to develop and use locally understandable symbols to visualize the question so that the participants have no difficulty in understanding.

2.8 Conducting PRA Sessions in the Case Study Area

Two PRA sessions were conducted in order to assess V&A issues at community level in the case study area for this book. One was conducted in Sapdhari *Union* and the other in Noapara *Union*, Maijbari *mauza*. Sapdhari is *char* land area, very prone to river erosion. Maijbari is also an erosion prone area and at the same time is susceptible to severe sand deposition. Both these areas are remote; there is no connecting *pucca* (paved) road from Islampur *Sadar Upazila*.

Sapdhari is mainly *char* land, which means newly emerged alluvium and sand deposited in the middle of the river. It is two to three km from the main land, separated by the river Jamuna. The data collection team had to travel 2–2 1/2 h by small engine boat to reach the *char* land from the mainland. The only mode of transport is engine boat or manual boats which are locally called “*nau*” or “*nouka*”. As this is mainly alluvial sand and silt, onion, garlic, vegetables, chili, peanut, local variety of *aman* rice as well as some HYV *aman* rice are grown here. Irrigation is practiced in some areas but in most areas irrigation is not possible because of the nature of the soil. Farming land size is small and fragmented, as

Table 2.6 Participatory rapid appraisal (PRA) session 1

Participants particulars		
Number of persons	Age/s	Occupation
1	43	Teaching
10	36–68	Farming
1	40	Politics
3	40–62	Business
1	40	Agriculture Block Supervisor
2	40–55	Union Parishad Members
1	58	Present Union Parishad Chairman
1	56	Former Union Parishad Chairman

Place Shapdhari Union Parishad Chairman's temporary Office, located in Gothail Bazar, Islampur

Time 6–10 p.m.; *Date* 4/11/06

these farmers are mostly marginal and poor, so they own small pieces of land. *Khash jami* (newly emerged *char* land owned by government) is distributed among landless and poor farmers. Muscle power/political power/*matbar* sometimes plays a big role in the distribution of *khash jami* and thus many deserving people are being neglected or overlooked. While performing the survey work in *char* land, the author and his team gathered local knowledge, and got to know the local *matbar*, local chairmen (previous and present), school teachers and commissioners. They were asked to help the survey team to organize the PRA sessions. The existing chairman helped the team to choose a place for the session and helped with selection of participants. The author and his team did the final selection of participants with the help of the chairman. The participants were informed earlier of the time, place and purpose of the session. In this session, out of a total of 20 participants 50 % [10] were vulnerable farmers and 3 were businessmen, 2 were *Union parishad* members, and one each were teacher, politician, agricultural block supervisor, present and former *Union parishad* chairmen (Table 2.6). It was held in the temporary office of the *Union parishad* chairman in Gothail bazaar on the bank of the *Jamuna*. Refreshments, small remuneration and their travel costs were provided. The intensive session was 4 h in total from 6 p.m. to 10 p.m.

The second session was organized in Maijbari *mauza*. The total number of participants was 20 and again 50 % of them were farmers, 4 were businessmen, 3 local student political leaders, 2 teachers of local school and 1 agricultural block supervisor (Table 2.7). Team members hired a small engine boat to reach the study area, taking two and half hours to reach there from Gothail bazaar. During the survey work, the author and team members were familiarized with local farmers and people from other professions. The author chose knowledgeable people of different social levels and skilled farmers for the PRA session. The session was held in the residence of a local school teacher. The participants were aware of the time, place and purpose of the session beforehand. They were entertained by the team during this session and travel costs were paid for.

Table 2.7 Participatory rapid appraisal (PRA) session 2

Participants particulars		
Number of persons	Age/s	Occupation
2	33–55	Teaching
10	33–65	Farming
3	25–41	Politics
4	44–65	Business
1	40	Agriculture Block Supervisor

Place Maijbari, Noapara Union, Islampur
Time 10 a.m.–2 p.m.; *Date* 4/11/06

In both sessions, participants attended and answered the semi structured questions with much enthusiasm. As the sufferers of the flood events, they have first hand experience, very clear understanding of the calamity and its severity and practical knowledge of how to cope with the above mentioned EFes. Even before the questions were asked, they gave brief overviews about each flood event, their nature, duration, frequency, peak, extent of damage done and how they reacted during and after the flood events.

The author adopted some concepts from the above mentioned general characteristics of PRA, and at the same time from the general characteristics of the two PRA sessions he conducted. These concepts are:

1. 20 respondents were considered for each session;
2. 50 % of them were farmers and the other 50 % were various professional people.
3. The answers were evaluated in a scale of 1–20 weighted value matrix.
4. In each session, 3 flood years, i.e. 1988, 1995 and 1998 were considered.
5. For each flood year, the respective V&A issues were weighted in a scale of weighted values;
6. Vulnerable issues were categorized as high, medium, low and very low;
7. Adaptation issues were also categorized as urgent, immediate and low in accordance with priority of need;
8. Degree of severity of each vulnerable issue was identified;
9. Similarly when the adaptation capability threshold was exceeded, some tactical interventions were identified and adopted;
10. These PRA sessions and the given evaluation process made an important methodological contribution for assessing V&A.

The number of respondents answering yes or no to one particular question was noted carefully in each session. With each question related to V&A issues they were asked to give a weighted value regarding severity and coping ability. For example, they were asked to measure the severity of each flood in terms of crop damage on a scale ranging 1–20. On the basis of their real world experience they came up with weighted values against each question which were unanimously accepted by all participants. Thus for each flood year two sets of weighted index

value were obtained, one in each PRA session as shown in Figs. 6.2 and 6.4 thereby giving rise to six sets of weighted index data. This provides the opportunity to compare vulnerability and adaptation capacity of the marginal farmers against three recent extreme floods. The “agreed weighted value index” is neither a mean of the six scores (there were two sites/sessions and three flood years therefore six weighted numbers have been assessed in six rows) nor a mode. After the participants were asked to score each flood event separately, they were asked to give an overall score against each V and A issues irrespective of year.

The weighting matrix indices have been used in environmental impact assessment studies; though not so widely in V&A assessment in climate change literature. Weighting Scaling (ranking or rating) checklists can be used in such comparisons and evaluations [126]. Scaling refers to the use of algebraic scales for the impact of each alternative being evaluated on each identified environmental factor. Ranking checklists are where alternatives are ranked from best to worst in terms of their potential impact on identified environmental factors. Weighting ranking checklists involves importance, that is, weight assignments and the relative ranking of the alternatives from best to worse in terms of their impact on each environmental factor.

The weighting index is a complex scaled checklist; the weighting procedure was originally developed in 1972 in order to evaluate water resources development projects in Ohio in USA [127]. This technique is useful for comparing alternative development options but could miss impacts. It is seemingly a quantitative method but uses value judgments [128]. Weighting indexes have widely been used in hazard literature particularly in water resource evaluation projects, both in pre-project and post-project analyses. Through this technique the comparative evaluation between pre-project and post-project data can assess the overall advantages of water resources projects. For example, the Flood Action Plan (FAP 19 and FAP 3.1) (Environmental Impact Assessment Study) in Bangladesh has examined the environmental impact assessment through the weighted index method (e.g. [129]). In these studies, checklists have been identified; in accordance with the checklists, farmers responded about post-project impacts within a weighted index scale. By that means, after establishing embankments, the range of positive and negative changes recorded on these checklists were evaluated through a weighted index scale.

The weighting scaled checklist is one of the simplest and earliest methods in EIA. It indicates broad areas of concern and likely impacts, which is good for scoping and structuring the initial stages of an assessment. It is a criterion for evaluation which can be incorporated into the listing, usually in the form of ranking or ratings. The weight-scaled checklists indicate the relative significance of each impact and may indicate critical values such as the ‘threshold of concern’ for each factor [130].

The weighting index scale enables comparisons of different impacts (identified by an assessment), and it also facilitates these comparisons. This has encouraged the use of scaling, weighting, standardizing and aggregation of impacts to produce composite indices, which offer single, apparently objective, benchmarks

[128, 131]. Although the weighting index provides quantitative comparisons, in some cases it gives a false sense of scientific precision. In fact, it gives a representative environmental quality index. It has some disadvantages. Weighting (and some other transformations of data) may not be as objective as they seem. Often they are just ‘value judgments of experts’ and conceal the original raw data and their meaning. Undistorted qualitative data may be preferable to transformed quantitative data. Weighting should be applied only to interval and ratio-scale data. The evaluation procedure depends heavily on the weightings and impact scales assigned [132, p. 112]. The importance of weightings is determined by a panel of experts. It compares the relative importance of all impacts.

In this study, weighted matrix index values are measured in a scale of 1–20. This 1–20 scale is based on the response of 20 participants to specific semi structured questions. The scale (1–20) has been divided into 4 categories which are discussed in detail in the V&A assessment chapter.

2.9 Other Data/Information Collection Techniques

2.9.1 Literature Review

In order to identify the research gaps, a large amount of literature was reviewed. Bangladesh flood related research work conducted since 1950 was reviewed for this purpose. Works on adaptation to climate change, agriculture vulnerability to climate change and EFEs, weighted index and environmental impact assessment were extensively reviewed.

2.9.2 Group Discussion

Group discussions were held when some confusion arose regarding filling questionnaires. By that means any difficulty understanding any issue about V&A was solved instantly in the field.

2.9.2.1 Group Interviews and Interviews with Block Supervisors: Some Observations and Findings

Two other more formal structured group interviews were organized by the author. The first was with a group of farmers in Dhantala *mauza*, in Belgacha *Union* a long way from the site of the PRA sessions, and the second with the block supervisors. The first group interview included a few well-experienced old farmers who

described their experience regarding coping with floods in the past and the sequencing of crops and types of crops that were grown at that time.

Interviews with block supervisors were held in *Upazila* agricultural office. Block supervisors are the representatives of the local agricultural office who work at field level and provide farmers with advice and assistance. They are responsible for collecting crop data in their respective areas. The author participated in a meeting where all block supervisors of that *Upazila* attended. It was focused on crop damage during flooding. For example, issues discussed included how many times farmers had tried to plant *aman*, both the local and high yielding varieties, as well as information on quantities of fertilizer and pesticides that are used on agricultural land during different cropping seasons. During the conversation the author found some discrepancy between his observations and the information provided by the block supervisors. Earlier farmers had mentioned to the author that block supervisors in general are very reluctant to do their duties. The author tried to get their records of crop damage information for their blocks. Although they said they have provided the local agricultural office with that information, they failed to show any copy of the paperwork.

At the community level, only these block supervisors work closely with farmers, this equips them with current knowledge of crop flood adaptation and the failure effects of autonomous crop adaptation. Information provided by the farmers (cost of agricultural input, cost of cultivation/land preparation, number of flood strikes, seedling cost, fertilizer cost, labouring cost, watering cost, pesticide cost) were cross checked with block supervisors. It was noted that information provided by the farmers was similar to that provided by the block supervisors regarding these issues. Block supervisors had made an important recommendation. They emphasized that in order to cope with multi peak floods, HYV flood resistant crop with short maturation time will prove invaluable.

The author also conducted an in-depth interview with Jahangir Alam, aged 35 years, from *mauza* Panchabahala, Village Panchabahala, *Upazila* Islampur. He is a marginal farmer who lost all his agricultural land due to river erosion in 1998. His observations helped the author to understand crop adjustment mechanisms and crop decision processes. His own experiences of the flooding were also very important in the author's data collection. For example, he mentioned that he had to sell his cow and personal belongings to buy food for his family and seeds for planting *Rabi*. He also mentioned that he did not get any return from cultivating *Gainja* in 1998. In his own words he described the flood events with their nature and severity which the author found very helpful in terms of understanding the recent and previous flood situations.

2.9.3 Media/Newspaper Information

News, editorials and post editorial on climate change and V&A from different newspapers such as the Daily Star, the New Nation, the Prothom Alo, the Jai Jai

Din, The Los Angeles Times, National Geographic, the New York Times, New Scientist and The New Age were consulted from time to time. Internet news regarding the GBM River Basin and the impact of climate change in this region was also considered.

2.9.4 Discussion with Professional People: Some Observations and Findings

Discussion with professional people was also used as a tool in this research, including policy makers at national level (agriculture expert, economist, geographer, environmentalist, and water resource experts) (Table 2.8). Late Dr S. M. H. Zaman, crop expert and former member of the Bangladesh Planning Commission was contacted as an agriculture expert in order to understand flood crop adjustment processes (described in Chap. 5). He gave some important hints about flood characteristics and community level crop adjustment processes. He agreed with the adjustment processes embraced by the farmers during these three major flood events as revealed by this study. He identified the flood crop adjustment differences between the 1970s and 1990s along with the likely cause of that.

As water resource and flood adjustment experts, late Professor M. Aminul Islam, former Vice Chancellor of the Open University and Professor K.B. Sajjadur Rasheed, former Professor of Geography and Environment, University of Dhaka, Bangladesh, were interviewed as main resource personnel. The structured questionnaire and identification of V&A issues were discussed with them. They agreed that it would be a methodological contribution to the research arena if V&A issues could be identified. In their opinion, vulnerable farmers' response to extreme flood had not previously been assessed in this way.

Dr A. Q. M. Mahbub, Professor and former President of Bangladesh Geographical Society was interviewed as a migration expert. He passed the opinion that the failure effect of autonomous adaptation is huge and as a consequence rural urban migration would rise alarmingly in Bangladesh.

Finally, the author discussed with Dr Q. K. Ahmad, former President of the Bangladesh Economic Association and IPCC lead author on sustainability, regarding economic consequences and its implication under climate change conditions on the Bangladesh economy in general.

2.9.5 Secondary Data

Some secondary data, both published and unpublished were considered. These data were used whenever needed. The resources used were as follows

Table 2.8 Key experts and issues highlighted

Name	Expertise	Subject	Issues highlighted
Dr S. M. H. Zaman former member of Bangladesh Planning Commission	Crop expert	Agriculture	Flood crop adjustment processes
Professor M. Aminul Islam, former VC of Open University	Flood adjustment expert	Geography and Environment	Assess V&A assessment
Professor K. B. Sajjadur Rasheed, former Professor of Geography and Environment, University of Dhaka	Water expert	Geography and Environment	Methodological contribution for assessing V&A issues
Dr A. Q. M. Mahbub, Professor and President of Bangladesh geographical society	Migration expert	Geography and Environment	Failure effect of autonomous adaptation is large and as a consequence rural urban migration would rise alarmingly in Bangladesh
Dr Q. K. Ahmad, President of Bangladesh Economic Association and IPCC lead author on sustainability	Climate change and Water expert	Economics and Environment	Economic analysis/impact and consequences and its implication under climate change conditions on agriculture in general

1. Small area atlas: *Mauzas* and *Mahallahs* of Jamalpur District, Bangladesh Bureau of Statistics.
2. BWDB: hydrology section-Hydrology data was collected.
3. Flood Forecast & Warning Centre, Motijheel, Dhaka, “Days when flood waters were above the danger level at the stations of Bahadurabath and Jamalpur” were collected.
4. Land and soil resources utilization manual, Islampur *Upazila*. Jamalpur (In Bengali) published by Ministry of Agriculture, Soil Resource Development Institute.

2.10 Recent Advancements in Vulnerability and Adaptation Assessment

Carter et al. [133, pp. 138–139] emphasized:

Traditional knowledge of local communities represents an important, yet currently largely under-used resource for climate CCI/V (climate change impacts, adaptation and vulnerability) assessment. Empirical knowledge from past experience in dealing with climate-related natural disasters such as droughts and floods... can be particularly helpful in understanding the coping strategies and adaptive capacity of indigenous and other communities relying on oral traditions.

The author has developed a V&A assessment method where indigenous, empirical and traditional knowledge have been given immense importance. V&A issues from past experiences in response to EFEs have been identified and weighted through PRA sessions where vulnerable farmers' opinions were carefully considered. Farmers' empirical knowledge helped understanding of the V&A strategies and adaptive capacity.

Downing and Patwardhan [134] stated that vulnerability is highly dependent on context and scale and care should be taken to clearly describe its derivation and meaning. Patt et al. [135] also addressed the uncertainties inherent in vulnerability assessment. Ionescu et al. [136] and Metzger and Schroter [137] proposed formal methods of vulnerability assessment but those are very preliminary. In order to assess response or potential response of a system to climate variability, the methods and framework must deal with the determinants of adaptive capacity [138]. Some quantitative studies use indicators related to adaptive capacity while other studies consider indicators that promote or constrain adaptive capacity [139–141]. Community based approaches which identify adaptive capacity, also provides insight into the underlying causes and structures that shape vulnerability.

Carter et al. [133] describe several approaches to assessing adaptation, although they came to the conclusion that establishing a general methodology for adaptation assessment is very difficult. Some approaches identified, are:

- The scenario based approach
- Normative policy framework
- Employing models of specific hypothesized components of adaptive capacity
- Economic modeling
- Scenario and technology assessment
- Risk assessment

While describing key conclusions and future directions, the 2007 IPCC report describes a set of methodological, technical and information gaps. One of the gaps is a collection of empirical knowledge from past experience. It has been emphasized that experience gained in dealing with natural disasters, using both modern methods and empirical knowledge, contributes to understanding the adaptive capacity of vulnerable communities and its critical thresholds. This study has considered vulnerable farmers' empirical knowledge and has identified and categorized these factors accordingly.

2.11 Ethical Issues

The study was conducted following University regulations. Before the interview began, each of the respondents was informed of the objectives of the study and why it has been carried on in their locality. They were also briefed about the confidential nature of the study and were assured that the information collected will only be used for this research purpose. The respondent enjoyed the right to decide whether he would participate or not and also was free to withdraw at any stage of the interviewing process.

The consent form used for this purpose is attached in Appendix II.

2.12 Data Analysis and Data Presentation

After returning from the field in Bangladesh, coding and entry of data from the questionnaire survey were completed. The coded data were entered into an Excel spreadsheet with each row representing a household. In total, data for 140 households were entered and information relating to particular individuals in the household was included in sequence as the spreadsheet was developed. This system of data coding was very useful for examining household characteristics but it was somewhat problematic when it came to examining characteristics of individuals within the household or responses to questions that allowed for multiple answers.

In addition to the surveyed household data, the author also collected a significant amount of secondary information from different government offices. This was not always easy. Administrative procedures, lack of attention to requests and some quite obvious deliberate hiding of information made it difficult to get some critical data. For example, the author had great difficulty getting hydrological data. There were many official processes that needed to be followed in order to get approval to take information overseas.

The author produced a relevant and required dummy table, and in accordance with the excel spreadsheet data he categorized the information in different groups. Sometimes the author used the pivot table analysis technique. The pivot table analysis comprises functions included in Microsoft Excel under the heading 'data'. The author has validated his Excel spreadsheet data in order to get pivot table results.

2.13 Research Limitation

Small sampling size is a limitation of this research. The seven most vulnerable *Unions* were selected for questionnaire survey and from each *Union* the two most vulnerable *mauzas* were chosen for this purpose. Ten households from each *mauza*

were surveyed and every alternate household was chosen as a sample. Time limitations and budgetary constraints were two important limiting factors in considering the sample size. Most importantly the remote location of the case study area made it physically impossible to carry on further. Because of the remote location, the study became increasingly time consuming and expensive.

PRA sessions were very intensive and they lasted for about 4 h. Some literature describes PRA sessions of 1–3 day, but due to the team's previous experience in the region the sessions were efficiently and expeditiously conducted. The author was satisfied with the enthusiasm of the participants and the spontaneous outcome of the sessions.

2.14 Summary

The research techniques used in this study have been described in this methodology chapter. The main approach is multi-method research (mixed research methodology) which contains some research techniques: field survey questionnaire, group discussions, in-depth case study, field observation, two PRAs and some secondary data collection. It is also a mixed method where mainly qualitative data have been transformed to quantitative data through these research techniques as it is mainly a “human response” study. Through these research techniques some research issues were accumulated and operationalized in accordance with the research objectives, which will be described in the following chapters. The issues are:

1. Socioeconomic and environmental assessment through 140 household questionnaire surveys in the case study area (Chap. 4).
2. Comparison of flood crop adjustment in response to three EFes in 1988, 1995 and 1998 through focus group discussion, group interview, in depth surveys and professional judgment (Chap. 5).
3. Methodological contribution for assessing V&A issues through PRAs and professional judgment (Chap. 6).
4. Assessment of failure effects of autonomous crop adaptation, that is, economic analysis of damage caused by the floods through 140 household questionnaire surveys (Chap. 7).

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