ARSENIC CONTAMINATION IN BENGAL BASIN: REINVENTING MITIGATION
THROUGH PARTICIPATORY SOCIAL INNOVATIONS

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation of KAKALI BHATTACHARYA CHAKRABARTI find it satisfactory and recommend that it be accepted.

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Arsenic contamination of groundwater and soil in West Bengal, India is a serious environmental health issue. Approximately 40 million people are exposed to contamination, 20 million being seriously affected. Risk mitigation faces multiple challenges, which are primarily historical, political, socio-cultural, and economic in nature. The current study investigated the factors that affect perception, understanding and mitigation of Arsenic contamination risk in West Bengal, and how culture-centered participatory communication can facilitate mitigation. 102 in-depth interviews and 2 focus-groups were conducted with villagers, local government representatives, doctors, scientists, teachers, health-workers, and college students, in 14 contamination-affected villages in West Bengal.

The study found multiple barriers to risk perception and mitigation. While some of those are due to the material reality of the water infrastructure, related to issues of access, availability, quantity and quality of water; there are myriad other issues caused by social, cultural, political, economic and structural realities of the region, both of which significantly hinder and is hindered by communicative issues. Even though awareness of water quality and its health impacts is
significantly low, there is no established channel of communication between risk-managers and end-user communities, nor do the government have any risk communication plans. This lack of communication, coupled with the physical qualities of the risk, and socio-structural issues in the region, causes barriers in dissemination of information, people’s understanding of the risk, and perception and exercise of personal agency in mitigation. It creates significant misunderstanding about the risk itself: patients are often discriminated for fear of contagiousness of the diseases, leading to social stigma, relationship discords and societal imbalances. Arsenic causes multiple health issues- loss of stamina for work, chronic skin lesions, cancer, ultimately leading to death. Manpower loss, especially male members’ loss, impacts both family and village economy: change in traditional livelihoods; educational opportunities are lost; girls are married off young thus affecting their overall well-being. These issues cause villages to remain in the vicious cycle of poverty. The study found need for community-based participatory research to empower communities to identify and mitigate water contamination risks. The study informs environmental and health risk communication and mitigation literature.

Keywords: cultural determinants of health, community-based participatory research, culture-centered approach, risk communication, environmental health, water contamination.
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Dedication

This dissertation is dedicated to my son, Ishan,
in the hope that I can guide him to be an advocate for social justice & change.
CHAPTER 1 | INTRODUCTION

Large-scale and chronic contamination of natural resources is on the rise around the world. Population growth, and unplanned and rampant use of natural resources are leading to widespread environmental degradation. While national and international level macro issues are much discussed beyond the geographical boundaries of the epicenters of those environmental crises, more local issues often remain overlooked. However, these local issues are often the result of large scale policy decisions that affect local people chronically in multiple aspects of their lives- socially, economically and health-wise.

Chronic groundwater contamination is an environmental crisis which is often caused by local issues, apparently having a direct impact on the people living in a small geographic area. However, gravity of such contamination cannot be ignored due to the vast impact it causes in public health and local economies. In addition, the interconnected nature of environmental resources, especially water is such that no contamination can truly be local, and is bound to have a ripple effect in the lives of many others beyond just the epicenter of the crisis.

Risk perception and mitigation get hindered by several historical, economic, political, social, cultural, demographic, and communicative factors that affect perception of risk and attitudes towards perceived risks. Prior research mentions a number of psychological variables, such as temporal and spatial discounting of risk factors (Bandura, 1997), social attenuation of risk factors (Kasperson et al., 1988), attention to other more acute risks (Chakraborti et al., 2009, 2010), lack of self-efficacy in risk mitigation (Inauen and Mosler, 2013), and available quantity of water as against quality of water (Chakraborti et al., 2009, 2010) that impact both risk perception and attitude towards perceived risks. Risk perception is also dependent on the nature
of the contamination itself. Perception becomes difficult if the contamination is natural and not visible through changes in the sensory qualities of the water (Doria, 2010), does not have immediate impact (acute impact) on human health but long-term impact (chronic impact) (Lupton, 1993), if there is considerable uncertainty about how much exposure of the contaminant will lead to health hazards (Chapman and Fairbrother, 1997), and if it occurs in areas with low-income population (Griffin and Dunwoody, 2000).

Investigation into prior risk mitigation efforts have reportedly seen limited success if one or more of the above parameters exist. In addition to the issues with risk perception, limited success in mitigation can also be accounted for due to the mitigation strategies itself. Several factors play a role: very often, expert-driven mitigation strategies fail when local social, cultural, contextual factors that affect risk perception are not taken into consideration; when the affected community does not participate in issue identification and mitigation related priorities; when the mitigation efforts do not address or alleviate the factors that hinder risk perception; when a successful model from a different location is applied to another location with similar contamination without thoroughly understanding the cultural and contextual differences (Parfitt, 2004; Bessette, 2004; Campbell and Vainio-Mattila, 2003).

Arsenic contamination of groundwater and soil in Bengal Basin (southern West Bengal & much of Bangladesh) is one such serious environmental issue that has been associated with severe health effects such as cancers of lung, bladder and skin; neurological, ophthalmological and gynecological problems; high blood sugar and high blood sugar, among others; leading to low stamina at work, manpower loss, seriously affecting the already impoverished economy of the region (Das et al., 1994; Chatterjee et al., 1995; Das et al., 1996; Chowdhury et al., 1999;
Chowdhury et al., 2001; Chakraborti et al., 2002; Mukherjee et al., 2003; Chakraborti et al., 2009; Das et al., 2009; Chakraborti et al., 2010; Mazumder et al., 2010). While the World Health Organization’s guideline value for Arsenic (As) in drinking water is 10 μg/L (WHO 2011), some 25% of water wells tapping the shallow aquifers contain much more than that (Jakariya et al., 2007). In consequence, approximately 78 million consumers (Chakraborti et al., 2009; BBS/UNICEF 2011) are at risk of adverse health effects (Yu et al., 2003) and as many as 22% of them may die because of As-related diseases (Argos et al., 2010).

So far, mitigation efforts have focused on installing technology to provide Arsenic free water, without communicating to people about the risks from contaminated water, how it affects them, or even communicating about the mitigation efforts that have been adopted. Investigation into prior mitigation interventions highlights lack of success in promoting Arsenic-safe water habits due to the lack of communication at the household and social levels (Chakraborti et al., 2002; Chakraborti et al., 2009). Risk mitigation has also been challenged by many socio-cultural and political factors, pertaining, for instance, to the nature of the traditional collectivist culture. While socio-cultural factors affect risk perception and attitudes towards perceived risk, difficulties in water management and development of alternative sources of water have been hindered by political reasons. Experts-driven interventions fail due to lack of continuous community engagement and regular feedback between mitigation teams and at-risk groups while poor economic conditions, and low literacy rates, and lack of access to reliable media outlets widen the communication gaps challenging mitigation (Das et al., 1994; Mukherjee et al., 2003; Hossain et al., 2005; Mazumder et al., 2010). Recently the scientific community working on the issue in the region has acknowledged that more socio-culturally driven efforts are needed to
mitigate the present crisis, not only in the already affected areas, but in the areas which have high potential for future contamination (Chakraborti et al., 2009).

Managing environmental risks is essential to reduce the risks to a level that is tolerable by society and the natural environment, to assure the risks can be controlled and monitored, and to avoid serious consequences (Renn, 1998). Environmental risk perception, to a large extent, is socially constructed, and therefore risk perception analysis needs to address not only physical environmental processes but also social, economic, cultural, and political views to provide more insights for environmental management (Nelkin, 1989; Johnson and Covello, 2012). The current study investigated the historical, political, social, and cultural factors that affect understanding and perception of risk from Arsenic contamination of groundwater. It also explored if and how participatory processes of communication between communities and experts can create opportunities for better understanding of risk and adoption of Arsenic-safe mitigation behavior by at-risk communities. Prior research shows that mitigation of environmental risks has been successful by engaging various stakeholders (communities, researchers, scientists and policymakers) in dialogues with each other, to collaboratively identify the risk factors, challenges in mitigation, and their critical solutions (Pohjola & Tuomisto, 2011; Penning et al., 2014). The study explored if and how action towards environmental risk such as water contamination and intangible chronic public health issues can be galvanized through community based participatory processes of communication. The study created a platform for developing dialogue among various stakeholders. It also provides both community-level and policy-level suggestions for developing a community-defined, culture-centered model towards risk mitigation in which health is protected at the same time as the traditional cultural practices, which have long been the key
to how individual and community health, are maintained and restored (italics added) (Arquette *et al.*, 2002). Participatory research promotes development of personal agency through self-efficacy in risk perception and mitigation, improved communication and negotiation skills with social and political agencies; These are pillars for sustainable and inclusive social change and well-being.

Theoretically, the study looked at how the concept of environmental risk perception among low income communities has been traditionally approached and provided critiques of the traditional approach to make a case for more participatory approaches in understanding the issue of risk perception, attitude towards perceived risk and risk mitigation behavior. The study was based on theoretical frameworks of culture-centered approach in communication, Community-based participatory approach and mental models. All these three approaches provide both theoretical and methodological foundations for understanding community perspectives in an in-depth, bottom-up, and culture-centered manner.

Through participatory and ethnographic research methods, the study conducted in-depth interviews with experts (political and bureaucratic representatives such as representatives of local self-government, civil servants responsible for village level program implementation, representatives from non-profit/charity organizations working on community development, and scientists working on the issue of groundwater contamination in the area) and villagers in Arsenic contaminated villages in fourteen villages in southern West Bengal, India, to understand their perception of the risk from Arsenic contamination, their own and each other’s’ roles and responsibilities, and challenges in mitigation. These responses were then analyzed and understood in the light of the unique historical, political, social, cultural, economic and
demographic factors and contexts of the villages, the villagers and that of the experts. Participatory and collaborative processes were adopted in various stages of the research, such as in the development of study instruments, identification of at-risk villages, identification of study participants, conducting interviews and understanding the responses, and in data analysis. Given the limitations of this study, all stages of a fully community-based study could not be adopted. A fully community-based study would instead involve three main components: community identify an issue and plan an intervention to affect change; community, in partnership with academia and government, conduct theoretically grounded and culturally relevant research to identify the problem areas; develop and implement translatable and implementable plans to affect change; monitor and evaluate factors of success and failure; and disseminate all learning from the projects into all stakeholders (Wallerstein & Duran, 2010). A true CBPR project is community-owned and community-driven, and therefore involves a long-term process and commitment (Israel, et al, 2000). This dissertation aims instead to focus on the formative elements of a CBPR approach such as understanding the issue from theoretical perspectives of CBPR; apply community-based participatory methods in data gathering; co-creating meaning of the data by involving community members as much as possible; and seeking participants’ suggestions on mitigation, thus building their perception of personal agency in mitigation. Even though the initial background research was done by me, but both experts and community members were involved later in the process to guide me with contextualizing the study instruments, finding the at-risk villages and identifying potential participants, based on the initial criteria developed by me. As it will be elaborated in the final chapter of this dissertation, this dissertation research can be viewed as a background research in itself, based on which a full-fledged CBPR project can be
planned, to roll out a risk mitigation implementation plan in future.

The study identified that Arsenic contamination of groundwater in West Bengal has serious health effects to a vast number of people living in both rural and urban areas. There are four primary issues with water in the area: access, availability, quantity and quality. The first three issues affect people so severely that water quality issues are often ignored. People in rural areas are more vulnerable due to lack or limited access to clean, purified water and lack of financial means to procure cleaner water. Mitigation efforts were greatly hindered due to poor economic conditions of the state. Distance from the nearest clean surface water source and the cost involved in supplying cleaner water is so high that it is unaffordable by both the government and people in the rural areas. Above all, the extent and effects of groundwater contamination is not communicated to the public in any organized manner by any of the government agencies. There is in fact no organized plan to communicate publicly about health effects of consuming contaminated water, nor are individuals told how to purify water at home using simple measures. Therefore, even if communities knew of the existence of contaminants in their water, they lacked knowledge and know-how of personal mitigation.

The focus of this study was not to suggest large changes that might need extensive political or economic intervention, but to bridge the communication gap between experts and villagers, to inform the stakeholders about the risk perception and mitigation challenges each group faces. This will inform development of culturally-centered participatory model of communication for risk mitigation.

**Organization of the Dissertation**

In addition to Introduction chapter (Chapter 1), this dissertation is divided into five
chapters: Chapter 2: Theoretical Frameworks; Chapter 3: Methodology and Methods; Chapter 4: Findings; Chapter 5: Discussions; and Chapter 6: Suggestions and Conclusions. The first chapter, the Theoretical Frameworks, discusses the traditional approaches to environmental risk perception, and discusses the theories and classic literature of risk communication. This chapter also provides critiques to those approaches, and provides arguments as to why those approaches might be inadequate in understanding and mitigating the chronic issue of groundwater Arsenic contamination in West Bengal, and other low-income village communities. This chapter also provides theoretical arguments as to why participatory approaches of communication such as community-based participatory research, culture-centered approach and mental models elicitation is more inclusive and engaging in environmental health risk research, and can mitigate risks more effectively. This chapter cites specific examples from the case, Arsenic contamination in groundwater in West Bengal, and argues why the participatory approaches and ethnographic research methods would be appropriate to study the issue of contamination in the particular location. The chapter also outlines the research questions of the study.

The next chapter (Chapter 3: Methodology and Methods) is loosely divided into two parts: methodologies and methods of the study. The first part, methodologies, discusses the ontological, epistemological and philosophical foundations of the study and why those methodologies are deemed appropriate for this particular case and the location. A major portion of the chapter is devoted to describing the location of the study (southern West Bengal, India), the problem of contamination, and the social, cultural, economic, political, ecological and health situation in the location. This description is meant to facilitate a deep understanding of the background and context of the problem which is essential for a qualitative study. This chapter
also provides a thorough understanding of my position as an insider and outsider in the research, in the location and my emotional connection with the research topic, and how that influenced my decisions throughout the study.

The chapter also details the actual methods used in the study. The study uses three methods: community-based participatory research, culture-centered approach, and mental models. The chapter describes the commonalities and differences of these three methods, and how they have been used in the study. The chapter also details out the issues and strategies of access to the locations and participants; ethics of data collection; actual data collection procedures; and how data was analyzed. It also explains how the study took care of the common issues with qualitative research such as reliability, validity, generalizability, and replicability.

The chapter on findings (Chapter 4) is also divided in two parts: the first part details the findings from the secondary research that was found through analyzing the secondary data, such as articles and reports about the health effects of the contamination; structure of India’s public health and bureaucratic administration, the organization charts, and the division of responsibility in maintenance of groundwater distribution. The second part details the findings of the study from empirical data collection, the interviews and focus groups with multi-stakeholders. The empirical data is divided into several themes and subthemes that emerged out of the analysis of interview and focus group data. In this chapter, I attempted to present and describe these data as factually as possible while refraining, to the extent possible, from subjective interpretation. Thus, I present what the observed patterns “are” without yet attempting to interpret what they “mean.”

The next chapter (Chapter 5: Discussions) a researcher’s understanding of the findings. The Discussions Chapter is subjective interpretation of the researcher, and critically analyzes the
findings from both primary and secondary data; and does so in relation to each other, and also in
relation to the social, cultural, political, economic and communicative background of West
Bengal and the issue of Arsenic contamination. It discusses the implications of the contamination
and the associated health issues, and its long-term direct and indirect impact on the development
and well-being of the region.

The final chapter (Chapter 6: Suggestions and Conclusions) provides suggestions for
mitigation. The suggestions are grounded in the empirical data from the study, and reflects what
the participants of the study thought would be useful in mitigating the risk. The suggestions also
emerged from empirical data from other studies on water quality issues in low and middle
income rural communities where participatory interventions have proved to be useful in
mitigating risks, and forming multi-stakeholder partnerships in water resource management.
CHAPTER 2 | THEORETICAL FRAMEWORKS

“Any scientific finding is usually to be assessed in relation to the theoretical perspective from which it derives and to which it may contribute.”

Silverman (2000)

Importance of theory in research has been echoed by many scholars. Theory serves as a map and guides the researcher to observe and find patterns in the phenomenon under study (Giele, 2006). Theories offer encyclopedic and comprehensive conceptual understandings of phenomenon that cannot be explained with simple logic. In social research, theories offer explanations to complex problems: how people, culture, social institutions, organizations work, and why they act the way they do. Theories provide researchers with different “lenses” through which they look and explain different social phenomenon. (Reeves, Albert, Kuper & Hodges, 2008). In any research study, theories offer explanation to what is already known of the phenomenon under study, and organize thoughts on what is there to know more about, to further explain various phenomenon which conform or oppose the existing explanations of similar phenomenon. This way, theories lay the foundation stone for a research study, and help formulate the research questions, methodology and the methods.

Kenneth Burke (1954) perceived that theory is like “grammar” that links agent, purpose, means, and scene to action in a qualitative study. For the present study, this chapter provides that fundamental “grammatical” foundation. This chapter discusses the theories that have informed the current study, and links various theories to seek and advance explanation of the phenomenon of risk perception and mitigation behavior of Arsenic-affected population in southern West Bengal. True to a study to effect social change, the chapter begins with discussing the traditional
approaches to environmental risk perception, and deliberates the theories and classic literature of risk communication with their epistemological and methodological foundations. It then critiques those approaches, and argues why those approaches might be inadequate in understanding and mitigating the issue of groundwater contamination in West Bengal, and other low-income village communities. It then introduces and elaborates the participatory approaches of communication such as community-based participatory research, culture-centered approach and mental models elicitation, and provides theoretical arguments as to why these approaches are more inclusive and engaging, and therefore can be more effective in environmental health risk research in low-income communities, and can mitigate risks more effectively. Along with theories, this chapter also goes over various other factors, such as psychological, social-cultural, economic, political and demographic factors that have been studied by other researchers through empirical studies and have been found to have had effects on environmental risk perception and communication by affected communities. All these theories and empirical understanding formulated the research questions and the course of the study. The chapter ends with outlining the research questions of the study.

**Traditional Approaches in Environmental Risk Perception**

Metaphorically, water has always been equaled to life. Recently, a lot of attention has been put into how it is important to preserve water for a safer future. In 2002, The United Nations started the Millennium Development Campaign, with water security and sanitation as one of the goals of environmental sustainability, thus making access to safe drinking water a basic human right. The statements of Ban Ki-Moon, Secretary General of the United Nations, in the foreword of the 2009 United Nations World Water Development Report, makes it clear:
“It is well known that water is life……water also means livelihoods. It is the route out of poverty for individuals and communities. Managing water is essential if the world is to achieve sustainable development…. This is important not only for development: it is a matter of security, too. Lack of basic services can contribute to political instability…. There has been a widespread failure to recognize water’s vital role in providing food, energy, sanitation, disaster relief, environmental sustainability and other benefits…. We must all work together to address this matter of life and livelihoods.” (UNESCO, 2009)

Lately, a lot of scholarly, philanthropic and governmental efforts have been diverted towards water security and providing access to safer drinking water. As of 2015, 29% of the global population (2.1 billion people) lacked safely managed drinking water services – meaning water at home, available, and safe, around 884 million people across the world remain without access to an improved source of drinking water (within 30 minutes of walking distance from home), 423 million people taking water from unprotected wells and springs, 159 million people collecting untreated surface water from lakes, ponds, rivers and streams (WHO/UNICEF Joint Monitoring Programme Report, July 2017). More than 3.4 million people die each year from water, sanitation, and hygiene-related causes. Nearly all deaths, 99 percent, occur in the developing world (WHO, 2008). The water and sanitation crisis claims more lives through disease than any war claims through guns (UNDP, 2006).” By 2025, 1.8 billion people will live in places classified as water scarce. People living in poverty are likely to be most at risk (UN, 2014). Increasingly, water is being considered as the new gold and there are predictions of future wars on water. By 2025, half of the world’s population will be living in water-stressed areas (WHO/UNICEF, July 2017). This has created a need for the scientific assessment of
environmental and health effects from water-related risks with social costs and losses that it directly has on living beings.

Significant research on general risk perception started in 1960s to understand people’s perception of risk from nuclear energy, industrial, natural disasters and certain commonplace risks, such as drunk driving, chronic and acute diseases, and financial risks (Sowby, 1965; Starr, 1969; Martin, 1989; Sjöberg, Moen and Rundmo, 2004; Reisinger & Mavondo, 2005; Khan & Burnes, 2007). One of the primary purposes was to facilitate preparation of risk communication advisories. Social science researchers from multiple disciplines researched and developed multiple theories and models to understand human perception of risk. At the theoretical level, researchers are interested in how the risks are perceived by individuals, and if there are certain generalizations possible in the way risk is perceived. From these deliberations, emerged several perspectives of risk perception theories. These approaches focused primarily on the objective measures of the probability of harm from risk, and how the probability of the harm can be minimized by directly intervening to minimize the physical risk itself. Research on human perception and assessment of risk also focused on understanding knowledge and perception of people of the objective qualities of the risk or the harms it may cause. Even though early risk theories aimed at providing solutions to conceptualization and assessment of risks growing due to social complexities and technological advancements, there exists lack of a common conceptual denominator to understand human perception of risk (Markowitz, 1991; Rohrmann, & Renn, 2000). Very few attempts have been made to develop transdisciplinary taxonomy of risk perception. Renn (1992) analyzed these transdisciplinary classifications of risk perception to suggest seven approaches in risk perception: (1) the actuarial approach (using statistical
predictions of probability of harm in a risk); (2) toxicological and epidemiological approaches including ecotoxicology; (3) the engineering approach and probabilistic risk assessment (to evaluate risks associated with a complex engineered technological entity such as an airliner or a nuclear power plant); (4) the economic approach and cost-benefit analysis of probability of risk and risk-safe behavior primarily pertaining to financial markets; (5) the psychological approach and psychometric analysis of individual perception of risk; (6) social theories of risk elaborating sociological approaches of structural factors in risk perception and assessment; and (7) cultural theories of risk using grid-group analysis. While the first three approaches, the actuarial approach, toxicological and epidemiological approaches and engineering approach, focus more on the physical characteristics and objective possibility of the risks that impact human risk perception; the economic approach, psychological approaches, social theories and cultural theories of risk focus more on the factors and ways the risk is perceived by humans.

All the risk theories follow a Rational Actor Paradigm which forms the philosophical basis of risk perception. It essentially holds that human beings almost invariably can link risk perceptions with decisions, and decisions with outcomes. The risk theories perceive that human beings are rational, goal- oriented and always choose the right available action to reach their goals. This understanding assumes that human actions are based on individual decisions, and humans always make rational decisions. It also assumes that human beings can perceive and foresee the outcomes and consequences of their own actions. This also means that if people identify risks, rational mitigation will automatically follow, and equilibrium will be maintained. These assumptions are extended to collective actions as well, which believes that collective of all rational actions maintain social and economic equilibrium and create perfectly coherent social,
political and financial institutions. Risk theories reduce all actions as rational individual actions, and all social actions are interpreted as aggregated and complex set of individual actions, without accounting for whether collective norms impact individual decisions. There is also an underlying assumption that risk is not perceived due to gap in knowledge between experts and lay people. Therefore, if people are provided with enough information without changing other external situations in which people live, they will perceive risk better and automatically follow mitigation behaviors. Renn and colleagues (2001) elaborate that *rational actor theories may be well-suited to describe individual actions under risks and uncertainties but fail to provide satisfactory explanations for collective risk actions or decisions*. In his systematic classification of risk theories, Renn (1992) identifies that not all risk theories provide application in all types of risk mitigation. According to his classification, the first four approaches, the actuarial approach, toxicological and epidemiological approaches, engineering approach and economic approaches can widely be applied in risk situations pertaining to insurance, health and environmental protection, safety engineering, and financial decision-making, respectively; whereas psychological approaches, social theories and cultural theories of risk can widely be applied in policy-making and regulations, conflict resolution and negotiations, and risk communication to individuals and groups. The current study looked into the psychological approaches, and social and cultural theories, its application in risk communication, and provided critiques of the theories.

Several theories have emerged within these three major theoretical approaches. Key theories within the psychological model are the Psychometric Approach of Slovic *et al.* (1986) and the Basic Risk Perception Model (BRPM) of Sjöberg (1993); Cultural Theory of Mary
Douglas (1978, 1996) within the cultural approach; and Social Amplification of Risk Framework of Kasperson et al. (1988) within the social model.

**Psychometric Approach of Risk Perception**

In the psychometric approach of risk perception, the emphasis is mainly on the assumptions that risk perception by humans is multidimensional and can be measured by developing scales ‘that reflect characteristics of risks that are important in shaping human (risk) perception’ (McDaniels et al., 1995, p.576). This assumption changes in case of ecological risks, which is found to be different from the main body of risk perception, in that more than 50 percent of the variance in perceived risk was explained by the factor impact on species, humans or others (McDaniels et al., 1995), which is largely specific to ecological risk. Slovic’s (1986) psychometric approach puts emphasis on the fact that perception of risk is dependent on the physical characteristics of the risk itself, and how its effects can be quantitatively measured with psychometric tools. Even though the approach includes certain social and cultural factors, these are explained as factors that affect the psychological and cognitive abilities of perception of risk. A considerable portion of Slovic’s approach focuses on perception of new or impending risks, and risks that can be easily perceived (such as nuclear weapons). This approach also states that risks that are unknown, new, and delayed in their manifestation of harm are unbearable in the public view (Slovic et al., 1986). This specific characteristic of risk perception is quite contrary to what has been experienced in risk mitigation in empirical studies. Bandura (1997) perceives that there is a tendency to discount risk if it is not imminent or imminently perceivable. To study how people evaluate long-term risks associated with the storage of radioactive waste, Svenson and Karlsson (1989) asked respondents to rate the seriousness of the consequences of a nuclear waste leakage, and found around 70% discounted the risks. Hendrickx, Van den Berg, and Vlek
(1993) carried out a similar experiment to understand how people discount effects of soil pollution. Subjects were asked to judge the riskiness of sixteen descriptions of different cases of soil pollution that varied on temporal delay and the likelihood of the negative consequences, between 5 to 90 years. It was found that close to 60% people discounted the risk.

The theory assumes that risk perception and reaction to risks is always rational, and if provided with more information, risks will be understood better and mitigation will follow. This approach, however, does not satisfactorily explain the great variance in risk mitigation behaviors across the world, and the social, cultural and structural factors that impede risk perception and mitigation (Wåhlberg, 2001). Slovic’s psychometric methodology of quantifying risks and risk related behaviors cannot satisfactorily capture this great variance (Marris et al., 1998). Last, but not the least, a study based on psychometric theory essentially is a quantitative one, which largely precludes community-based participatory approaches. The theory, when practiced empirically almost always follows a top-down approach, conducted through questionnaire surveys and analyzed by the experts through statistical-mathematical modeling and explains very low variance of perceived risk (Sjöberg, 1996). Also, psychometric theory may not have much opportunity to include community perspectives in the study design and practice, and may not include the social, cultural and contextual variations of the respondents in the analysis (Marris, Langford, O'Riordan, 1998). The data generated through these studies may facilitate developing of persuasive communication of risk information aimed at behavior change, without being able to suggest the structural changes that may impede them (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Fife-Schaw & Rowe, 1996; Sparks and Shepherd, 1998).

**The Basic Risk Perception Model**

Even though Sjöberg (1996) perceives his risk perception model, the Basic Risk
Perception Model (BRPM) as an alternative and improvisation of the psychometric theory, BRPM is an extension of the psychometric approach. It incorporates and expands on the psychometric dimensions and explains more variance in risk perception (Sjöberg and Drottz-Sjöberg, 1994), by adding factors such as attitude, risk sensitivity, fear, and trust (Sjöberg, 1996) and moral value (Sjöberg and Drottz-Sjöberg, 1993). BRPM recognizes social-psychological factors (especially trust and moral value) in addition to the cognitive factors (attitude, risk sensitivity, fear) that are also instrumental in risk perception. This approach thus acknowledges that risk perception is not only dependent on the physical characteristics of the risk itself, but also on the context of those who perceive and get affected by risks. However, BRPM is still predominantly a psychometric theory, based on the assumption that risks are always rationally perceived and mitigated, and does not adequately recognize the variances in historical, and contextual factors. The psychometric theories do not recognize that mitigation does not always follow perception of risk, and therefore does not explain why risk perception is not always followed by mitigation attempts or behaviors. Also, like Slovic’s (1986) psychometric theory, studies with BRPM are essentially quantitative studies conducted with methods such as questionnaires, factor and regression analyses, without many opportunities for research that follows collaborative process in *co-construction of research through partnerships* between researchers and people affected by and/or responsible for action on the issues under study (Jagosh, Macaluy, Pluye, Salsberg, Bush, Henderson, Sirett, Wong, Cargo, Herbert, Seifer, Green, and Greenhalgh, 2012). Participatory research promotes culturally appropriate methodologies, increases the quality of research outcomes, both the research process and outcomes are more grounded in reality, and therefore creates higher chances of bringing systemic
changes through the interventions informed by such research outcomes (Jagosh et al., 2012; English et al. 2006). In a study to understand barriers in health risk perception to reduce health disparities in tribal communities, Schulz and colleagues found that participatory research increased community ownership of the research and understanding of the research protocols better, and provided better results (Schulz, Israel, Parker, Lockett, Hill & Wills (2001). Neither of the psychometric theories provide opportunities for this process and outcome of research.

**Cultural Theory of Risk**

Cultural Theory of Risk, originating in the works of Mary Douglas and Aaron Wildavsky (1978, 1982, 1996) primarily explain how people from different culture groups understand and react to various risk and risk related messages (Wildavsky and Dake, 1990). The cultural theory of risk predicts and explains “what kind of people will perceive which potential hazards to be how dangerous” (Wildavsky and Dake,1990, p. 42). It interprets that individuals come to make judgments about hazard, risk and threat as part of the evolving social and political debate about rights to know about the risks, and the provision of justice for those likely to be affected. These considerations are therefore inseparable from issues relating to power, justice and legitimacy (Tansey & O'riordan, 1999). Cultural theory recognizes risk as a culturally constructed phenomenon, and is thus viewed by people from different cultures differently. Different cultures have different social structures and social rules, socialize their members differently, and thus create different worldviews among them. These worldviews will decide how they perceive risk and comprehend risk related messages. There are four views on how culture has been perceived in the West: as an elite canon, as a set of beliefs and ideas, as reflection of socio-economic relations, and as processes of dialogical negotiated sense-making through lived experiences (Hornberger, 1998). The cultural theory perceives culture as a set of beliefs and ideas, and as
reflection of socio-economic relations.

At the heart of the theory lies a grid-group typology that identifies four principal cultural worldviews: fatalistic, hierarchic, individualist, and egalitarian. Group is defined as the social institutions people belong to, and grid is defined as the set of beliefs, and values that characterize the social and political institutions. People adhering to these worldviews all belong to different social structures, hold different ideas about institutions and structures, and therefore may perceive risk differently.

Fatalists and those who value hierarchies tend to reside in societies with externally prescribed rules and choices. Fatalists are part of individualized groups and believe that everything that happens will happen and they have no control over anything. Hierarchists believe that rules are for everybody, and that they should be followed for the benefit of all. Hierarchists believe in authority, strict social structures and rules that are part of collectivized institutions. Egalitarians are also part of collectivized societies and believe that everybody has equal rights on everything. They fear authority as they think authority brings corruption and power gets concentrated in the hands of few, and rights are violated. Egalitarians and individualists belong to institutions and societies with less externally prescribed rules and choices. Individualists believe in self-autonomy and believe everybody should do what is right for themselves. However, the theory does not clarify if it is acceptable when one’s self-autonomy has harmful effects on others.

Politically, egalitarians left oriented, hierarchists and individualists are oriented towards the right, whereas fatalists are often apolitical as they believe it does not matter who they vote for. By nature, fatalists are capricious, hierarchists are perverse and tolerant, individualists are
benign till their freedom is protected and change attitude when confronted in their autonomous zone, and egalitarians are protecting and communal. Hierarchists and individualists believe that nature and world have their own systems of restoring order, and when confronted it will do so. Therefore, there is no reason to worry, as long as it does not harm the world order (for hierarchists), and it does not disturb individual autonomy and freedom of individuals (for individualists). Fatalists believe that nature is unpredictable and will do what it wants. Egalitarians believe that nature is precarious and vulnerable and belong to everybody, therefore needs care and protection for everybody’s wellbeing.

Cultural theory explains that people belong to one of these four worldviews as a result of their affiliation to different grids and groups. These are not only characteristic of individuals, but also societies and countries. Cultural theory upholds that people will perceive risk and risk related messages, based on the characteristics of their worldviews. Thus, for example, a campaign message for individualists need to target their individual benefits, whereas for hierarchists at the institutional level, for egalitarians at the communal level, and for fatalists by highlighting the personal agency in bringing about change. The messages will then be confronted with less dissonance, and will have higher likelihood of being accepted.

One of the primary critiques of cultural theory is that the group-grid typology is too rigid, and it does not adequately explain how the worldviews in the grid-group typologies came to be the way it has been explained, how people first get classified into them and whether these are classifications of nations, subcultures, or micro-level communities. Cultural theory holds culture as a fixed set of beliefs and rules, and cognition, and reaction to the cultural norms at the individual level (Tansey & O'Riordan, 1999). It does not explain whether people always remain
in one of the four grids and group with the same worldview, or if there are any shifts and overlap between the worldviews. It does not explain the variances and heterogeneity within one culture and how the lived experiences of the people explain their reaction towards the external messages. Another critique of the theory is that the worldviews uphold risk perception as an essentially rational act, and the worldviews are very Western by nature. The rigidity in the definition of culture and lack of explanation on how continuous life experiences affect the grid-group identification make the Cultural Theory of risk an unsuitable approach for participatory research.

*The Social Amplification of Risk Framework*

The Social Amplification of Risk Framework (SARF) conceived by Kasperson and colleagues (1988) conceptualizes risk partly as a social construct and partly as an objective property of a hazard or event (Kasperson, Renn, Slovic, Brown, Emel, Goble, Kasperson, & Ratick, 1988; Renn, Burns, Kasperson, Kasperson, & Slovic, 1992). It necessarily shifts from the idea that risk perception is only psychologically constructed and dependent on individual cognitive behavior (Fischhoff et al., 1978). It puts emphasis on the claim qualified by anthropologists that social context and culture shape perceptions and cognition (Douglas and Widavsky, 1982, Johnson and Covello, 1987). According to Kasperson and colleagues (1988):

*Social amplification of risk framework discusses that risk events interact with psychological, social, and cultural processes in ways that can heighten or attenuate public perception of risk and related risk behaviors. Behavioral patterns, in turn, generate secondary social or economic consequences, but may also act to increase or decrease the physical risk itself (Kasperson et al., 1988).*

Whereas attenuation of risk is indispensable that it allows individuals to cope with the multitude of risks and risk events encountered daily, it also may lead to potentially serious
adverse consequences from under-estimation and under-response. Social amplification of risk framework maintains that understanding of risk perception needs understanding of technical, psychological and cultural factors that affect assessing and perceiving of risk.

Even though SARF provides a more balanced view about risk perception, and is interdisciplinary in nature, SARF has been criticized for being too simplistic. Despite recognizing risk perception as impacted by social, economic and political processes, it neither explains the processes in detail, nor explains the variance in their impact.

Research has highlighted the limitations of the simple sender-message-receiver model used in SARF (Bennett et al., 2010). SARF puts too much importance on the channels of communication, but not on the individuals to understand how the actors involved themselves may interpret the information. SARF assumes that the public are inherently ignorant and that’s why risk gets attenuated, and that only persuasive messages can ‘correct’ the situation. This approach makes SARF very expert-driven and top-down in nature. Also, it is not that all heightened risk perceptions are undesirable. Depending on the nature of the risk, it might be necessary to heighten risk to mitigate them effectively (Pidgeon & Barnett, 2013).

Empirical Studies on Risk Perception

Based on the dominant paradigms of understanding risk perception through psychometric approaches, several empirical studies have been conducted by scholars who have identified various factors that impact risk perception and mitigation behaviors, especially those pertaining to environmental and health risks. These variables fall into three primary categories: psychological variables (such as norms, self-efficacy, self-regulatory behavior, memorability, motivation, etc); social-contextual variables (opportunities and alternatives to risky behavior, infrastructure, etc); and cultural-demographic variables (age, gender, socio-economic status).
These variables often overlap, moderate and mediate each other.

Psychological variables

According to Gifford (2011), in spite of high awareness of environmental pollutions and risks, there are individuals and organizations that expend much less effort to mitigate these risks because of several impeding structural factors. For instance, low income status can be a structural deficit in one’s willingness to buy environmental-friendly solar panels, or lack of reliable public transport may be an impediment in adopting an alternative to driving. At the same time, Gifford pointed out that even those who are not severely restricted by structural barriers do not make enough endeavors to mitigate risk due to what he identified as “dragons of inaction” or psychological barriers that hinder risk perception. Gifford categorized twenty-nine variables into seven categories. Some individuals exhibit limited cognition about the risk problem due to genuine ignorance. People might not know about the physical characteristics of a risk, or even when they know about the risk they might not know how to mitigate the risks. For example, it is observed in most polls, that people show little awareness or knowledge about climate change, so automatically it can be assumed that they will not take any personal action, or are less likely to support collective actions and/or policies mitigating climate change risks. Even those people who are aware of the risks might not know how the risks affect themselves, consequently affecting their cognition of the risk and mitigation action. Cognition of risks also get limited by the uncertainty of risks. Similarly, individuals may display ideological worldviews, such as religious worldviews or political worldviews that may preclude pro-environmental attitudes and behavior. For example, people with strong religious adherence may believe that God or Mother Nature will not let any harm occur to them or to the nature (Mortreux & Barnett, 2009). Researchers have
found that those who live in affluence have belief in a sense of immunity against environmental risks, due to their perceived higher capacity to mitigate risk (Dunlap & McCright, 2008). People are also inhibited by comparisons with the action taken by others in the social network. Social norms play a big in risk perception and mitigation. While norms may facilitate risk perception, it may also cause regress. For example, in a study by Schultz, Nolan, Cialdini, Goldstein, & Griskevicius (2007) on residential power use, when homeowners were told about the average energy use in the neighborhood, people modified their behavior to fit into the societal norm which resulted into reduction in energy use by some households, but there were some other households who increased energy use to fit into the societal norm. Sunk costs and behavioral momentum affect risk perception and mitigation if the mitigation needs significant new investment or discarding of an already made significant investment, or if it needs significant change in a habitual behavior. For example, in a study in rural Kenya aimed at encouraging people to use treated piped water, people found it challenging to start filtering water from untreated source as it required significant change in behavior and involved cost. Skepticism and lack of trust toward experts and authorities have significant effect on risk perception as it often makes people disbelieve in the risk communication advisories and mitigation programs. It can also lead to complete denial of an existing risk, such as climate change (Norgaard, 2006). Finally, positive but inadequate behavior change can impact mitigation behavior, because inadequacy of the action might not lead to desired result that can frustrate people and they might withdraw from continuing the behavior. Such withdrawals are common in climate change mitigation behaviors. For example, people may take up using public transport in place of cars, in anticipation of a fast change in the greenhouse gas emission, but may be disoriented when
significantly perceivable changes do not occur immediately. Such behaviors are easier to adopt, but needs collective efforts and provides gradual change. If *pro-environmental intent does not correspond with pro-environmental impact*, it may lead to withdrawal from the behavior (Stern, 2000).

Norms have a substantial impact on human psychology (Cialdini *et al.*, 1990). Empirical studies conducted on water-related behavior suggest that both injunctive norms (perceptions of whether or not close associates and important people approve of a particular behavior), and descriptive norms (the extent of influence other people have on an individuals’ behavior and attitudes) influence water contamination risk-related behaviors (Mosler *et al.*, 2013; Dolnicar, 2011). For example, a household survey conducted in flood-prone cities of eastern Australia concluded that the likelihood of having a flood insurance cover was impacted by the ways in which the individuals situate themselves in their social circles or the society, and was associated with perceived social norms, but not with perceived flood risk. Individuals purchased flood insurance when their social peers also bought flood insurance, and when they wanted social conformity with the peers in their social circles. Thus, individuals in this case were highly influenced by social peers’ perceptions and attitudes about flood risk, notwithstanding whether they themselves perceived the risks or not. Risk perception was influenced - indirectly through shaping perception of social norms (Lo, 2013).

Self-efficacy, defined as one’s belief in one’s own capabilities to organize and execute a course of action required to manage prospective situations (Bandura, 1997) was identified by Inauen and Mosler (2013) as an important factor in risk perception. They identified several self-efficacy factors that impact risk perception and have potential impact for behavior change.
interventions, such as action self-efficacy i.e. individual’s confidence in their own ability to prevent a health threat; maintenance self-efficacy i.e. the confidence that they would engage in a behavior even if there were barriers in executing the behavior; recovery self-efficacy i.e. the confidence that they would start a behavior again after they stopped for a few days. Recovery self-efficacy, commitment to a behavior, and adherence to descriptive norm were found to have high potential impact for behavior change interventions in a study conducted by Inauen and Mosler (2013) with 1,268 households in Bangladesh to identify the acceptance and use of available safe water options in villages with Arsenic contaminated drinking water. They found that the individuals who have higher adherence to social norms, for instance if they see other people collecting water from safe-wells and there are social expectations of doing that, they will be more likely to follow to water-safe behavior or return to that behavior even if they stop it for some time. At the same time, the study found that those with lower pressure to adhere to social norms, for instance people who do not have social peers collecting water from safe wells have lower perceived self-efficacy and demonstrated lower use and acceptance of safe water options.

Mosler’s RANAS (risk, attitudes, norms, ability, and self-regulation) model puts special emphasis on action control as one of the determinants of behavior change in risk situations. It reflects the efforts people carry out to perform intended behaviors (Sniehotta et al., 2005). Other self-regulation factors, such as remembering and commitment also impact risk perception. The ease of remembering to perform an action such as use of cleaner water at a specific time or a specific situation such as while drinking, cooking or bathing children, and commitment towards a particular behavior such as drawing water from a safe source in spite of barriers such as distance from the source of water, lack of time (Tobias, 2009) may invoke a past memory when a
positive action brought positive results and negative action brought negative results. This way, memorability impact risk perception and mitigation behavior. Prior knowledge and previous experience of similar risk situations affects attitudes towards environmental behaviors (Comby et al., 2014). In a cross-national mixed-method study in the UK and Portugal to explore the factors involved in public perception of the quality and risks of drinking water (Doria et al., 2009), risk perception was found to be influenced by the available external information such as risk communication advisory from water regulatory authorities and government about the risks of drinking water from certain sources, and past health problems such as diarrhea, hepatitis from consuming water from the same sources. Further, in a study conducted by Seydlitz, Spencer, Laska, & Triche (1991), to understand information seeking behavior following a salt water intrusion in the Mississippi River that affected drinking water in the New Orleans metropolitan area, the authors found that those who had access to and could recall the risk-related information, and/or had past experience of water-borne diseases were more likely to be aware or careful about potential risks in water and suspicious of water quality.

Several authors found that perception of water quality was dependent on the changes in the organoleptic or readily discernible qualities of water such as color, clarity, odor, taste, and smell (Hurlimann et al., 2008; Doria et al., 2009; Doria, 2010). Unless there is perceptual change in at least one of these qualities, primarily odor or flavor, water is often not considered contaminated or polluted. Odor, taste and flavor in water cause people to perceive risk. The lack of these qualities causes them to not perceive risk, irrespective of the objective qualities of risk found through test reports (Doria, 2010). For example, in a 1995 study in Québec, Canada with 2009 respondents to evaluate consumer attitudes on taste and tap water alternatives, 14% were
found to be dissatisfied with the odor, and 30.6 % with the taste or flavor of tap water, leading to only 50.8 percent of the consumers using tap water and 42.7 % consumers regularly using bottled water (Levallois *et al.*, 1999). Similarly, a 2013 study by Inauen and Mosler in Bangladesh found that the consumers who do not see risk in the water or do not adopt safe water behaviors are the ones who also do not complain about the organoleptic properties of water.

Research suggests that environmental attitude factors such as instrumental beliefs (outcome expectancies) about costs in terms of money, time, and effort, and benefits in terms of savings or other advantages of a new behavior significantly impact mitigation behavior (Huber *et al.*, 2014; Mosler *et al.*, 2013). In a 2014 action research study by Huber, Tobias, & Mosler in Ethiopia, to identify psychological factors influencing fluoride-free water consumption, impact assessment data showed three outcome expectancies as most relevant: cost persuasion decreased the perceived costs of behavior change, improved the perceived taste of filtered water and perceived positive health impact of the behavior. This positively impacted behavioral change to adapt fluoride-free water and increased consumption of cleaner water.

None of the psychological variables in risk perception independently or adequately explain the variance in risk perception or the external conditions under which the psychological variables are impacted. For example, psychological variables describe how social norms psychologically impact risk perception, but does not account for society’s social-cultural conditions that mandates people to follow social norms, or the sanctions people might face when social norms are not followed. In that sense, risk perception does not remain a psychological factor only, but a factor deeply rooted in the society’s social and cultural practices.

This also proves that perception of risk is not only a psychological state of mind, but is
moderated by many other factors. Also, the psychological factors are not entirely individualistic in nature. Perception of risk is impacted by the origin of risk messages and the relation with the risk messengers, and available opportunities of receiving risk messages. The following section unfolds some of the factors directly related to information and communication of risk messages and how they impact risk perception.

Knowledge, information and trust

Knowledge about water quality, present or prior knowledge or lack of knowledge about contamination, alternative sources of water, severity of different contaminants and its potential health impacts, affect the way risk is perceived (Mosler et al., 2010; Artell et al., 2013). More knowledge about sources of contamination, potential risks in consumption of contaminated water, and benefits of using alternative safer water is linked to increased likelihood to engage in safer water habits (Dolnicar, 2011), whereas lack of knowledge about these might lead to apprehensions, and misperceptions about the water quality (Haile et al., 1996). Several studies show the important role of information and knowledge in water related behaviors. In a 2007 study by Madajewicz and colleagues in Bangladesh, the authors conducted interviews with more than 2000 people in few villages affected with Arsenic contaminated groundwater. A part of the respondents was previously given information about Arsenic risk in water, through a public health survey, public education campaigns and health checkups. Results indicated that the people understand water quality concerns better, perceive risks better and significantly increase use of safe water sources when provided with risk-related information. The authors found that 60% of the respondents who were given information about risk levels of their wells in the previous stages of the study changed to a different well. Also, close to 98% respondents could recall the
information about safety of the wells in their proximity as the water quality of those wells directly affected them (Madajewicz et al., 2007).

Information of a present or imminent risk on a given community is an important factor in deciding how the risk is perceived by the community. Even when community residents are informed that environmental contamination has occurred, they face significant challenges in understanding what that information means for their community, their property, and their personal or family’s health (Zikmund-Fisher et al., 2008). Doria (2010) observes that information from the mass media predominantly influences perceptions at the societal level; and interpersonal information mostly affects perceptions at the personal level. External information about risk, from media, work colleagues, and doctors, but not from friends and family impacts estimation of risk (Doria et al., 2009). Risk perception is influenced by people’s previous encounters with scientific information released in/through other information channels (Trumbo and McComas, 2003). This is due to the significant gap in communication between scientists and the stakeholders (Morgan et al., 2002). Communication of scientific information often raises uncertainty among common people due to gap in understanding the contexts of the information between experts and the lay people (Ascher, 2004). In a study conducted by Slimak and Dietz (2006) with a randomized sample of 404 lay public and a select group of 210 risk professionals at the U.S. Environmental Protection Agency (US EPA), respondents were asked to rank 24 ecological risk items, from global climate change to commercial fishing. The lay public was found to be more concerned about low-probability, high-consequence risks whereas the risk professionals are more concerned about risks that pose long-term, ecosystem-level impacts. The difference in the ranking of the same ecological risks by the two groups of people were attributed
to the level of knowledge they had about each of the risks and their consequences. Risks are
often evaluated by the lay persons based on its possible personal impact on the risk evaluator and
the immediate social and family network whereas experts evaluate risk based on its possible
magnitude of impact (Slimak & Dietz, 2006). These factors create difficulty in creating
persuasive risk communication materials, due to this differential understanding of the importance
and intensity of risks by experts and lay-people.

Perception of water quality and associated risks is impacted by trust in information
sources and attitudes towards the particular transmitter(s) used to convey the message, such as
water regulatory authorities, government, and media; and active information seeking behavior,
(Artell et al., 2013; Comby et al, 2014; Doria et al, 2009; Menegaki et al., 2007). People’s
perception of environmental risk and their sense of personal agency to take meaningful action are
strongly linked to concerns about the trustworthiness, accountability and interests of the
controlling or regulatory institutions (Bickerstaff, 2004). Other factors potentially influencing
trust include perceptions of care, value similarity, competence, integrity, cooperation and
openness (Doria et al, 2009). Zikmund-Fishera, Turkelson, Franzblau, Diebol, Allerton, &
Parker (2013) conducted a survey with 50 community members in Midland and Saginaw
counties in Midwestern US, to understand how source of information impacts risk perception.
They included questions such as knowledge about contaminants, community members’ level of
concern and their feelings about government, perceptions of trust on government related to
environmental concerns, concerns about withholding of information by the government, and
respondents’ specific satisfaction with information about contaminants. It was found that less
information about the contaminants from regulatory authorities leads to higher disparity between
belief about contaminants and actual contamination situation. Trust in the information source was lower when there was less satisfaction about the availability of information (Zikmund-Fishera et al, 2013). If the trust in the source is high irrespective of availability of information, perceived risk was lower than actual contamination situation, whereas if trust in the source was low, there were more confusions, apprehensions and risk perception was inconsistent (both heightened and attenuated) with the actual contamination situation (Madajewicz et al., 2007).

Contextual factors

Literature on risk related behaviors suggest that any investigation about risk perception should be conducted within the context the behaviors were performed (Cooper et al, 2004). Perception of risk goes beyond the individual (Weinstein, 1989) and follows from the specificity and variability of human social existence that it should not simply be presumed that identical instruments have the same meanings in different contexts (Boholm, 1998).

There is a paucity in literature about how context in risk related behaviors can be defined, and what different factors can be considered as contextual factors. A review of literature elaborates that contextual factors vary greatly and can be divided in five broad categories: social contexts, economic contexts, cultural contexts, political or policy contexts, and situational contexts (Chappells et al, 2014; Mosler et al, 2010; Menegaki et al, 2007).

Through correlation of socio-demographic data and frequency of testing of water quality, measured by self-declared report of actual frequency of testing, Chappells et al (2014) found that people in rural areas are significantly less likely to have water quality test, due to inconvenience of testing. Measured through questions like “finding a testing laboratory was easy”, “deciding what contaminants to test for was easy”, “collecting the sample bottles was convenient”,

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“collecting the water sample was easy”, and “delivering the sample to the lab was convenient”,
inconvenience was found to be a big reason for continued use of water from same source,
irrespective of perceived bad quality of water, leading to gradual acceptance of risk.

Haile and colleagues (1996) studied the situational factor of convenience of accessing
alternative resources in a study conducted in Santa Monica Bay in California to understand why
people came to Santa Monica Bay, despite knowledge of possible adverse effects on health due
to water contamination at the Bay. They found the usability value of beach is marked by
availability of infrastructure (measured as how well the infrastructure is around the beach, how
easily it can be reached and services be availed), cost (cost of availing different services and
cost-benefit analysis), safety (what are the safety measures available and how easily they can be
accessed), alternative opportunities (whether another beach provides equal cost-benefit and
convenience), etc.

Mosler and colleagues (2010) also found similar correlation in their study of risk
perception in well-water and convenience of using alternative water. In a study in rural
Bangladesh with high Arsenic contamination in ground water, they found that risk perception of
water contamination and subsequent risk prevention behavior was dependent on convenience to
adopt alternative water drawing behaviors. Even though people were told that deep tubewells
were a better and safer alternative for arsenic free water, it was found that there were several
impediments in accessing those due to lack of convenience, such as the time needed to collect
water from the deep tubewell including the long waiting time; operability of the tubewell;
seasonal limitations on using the deep tubewell; laboriousness of collecting water from the deep
tubewell compared to the shallow tubewell; and the accessibility of arsenic-safe water in terms of
distance. People perceive the existing sources of water as less contaminated if the alternative is more difficult to access (Mosler et al., 2010), and risk is perceived fair (Haile et al., 1996).

Prior use of a particular type or source of water, and positive or negative experience associated with it impacts perception of risk from the source. Chappells and colleagues (2014) measured association of risk perception of arsenic with users’ prior experience of health problems from using contaminated water. Residents of areas with higher proven risk were found to be more likely to report having had a problem with their well-water, to be more aware of problems with well-water in their community, and to be more concerned about arsenic compared to the residents in the areas with potential, but not proven contamination.

In a study to understand willingness to pay for recycled water for agriculture, Menegaki, Hanley, & Tsagarakis (2007) found that water shortages have more influence on acceptance of alternative water. By measuring the degree of seriousness consumers assign to the problem of water shortage, he found that many farmers, not just those who were facing water shortage problems, thought that it was good to use alternative sources of water for irrigation. Those who recognize water shortage to be a serious problem are ready to do more about it if provided with alternative sources of water.

One of the contexts that Inauen and Mosler (2013) found in perception of risk in water quality is the perceived chance that the respondents or their family would get poisoned by the contaminated water. They measured it using items such as chance of contamination on self, chance of contamination on family, and chance in comparison to others. They found strong correlation between higher perceived chance of contamination on self/ family and perception of bad water quality, and vice versa.
Relative importance of other social responsibilities and cultural dynamics, interacted with social norms often impede mitigation, even if risk is perceived (Chakraborti et al., 2008; Kuruppu, 2009; Mosler et al., 2010. In a community-based participatory study in Kiribati, Kuruppu (2009) found that even though people perceived risk of water contamination, they lacked personal agency in mitigation. Residents were found to be contributing significantly to the local church and believed that the church will do everything necessary for risk mitigation and residents’ better health. Consequently, they paid to the church, but not in developing any mitigation measures by themselves.

Demographic factors

Demographics are often weakly but significantly associated with many psychological and situational variables, such as perceptions of risk, organoleptics, knowledge, selection of information channels, personal agency of mitigation, information seeking and processing behavior, access to risk mitigation and adaptation such as healthcare, alternative water source (e.g. Kraus et al., 1992; AWWA, 1993; Stevens, 1996; Parkin et al., 2001). Various demographic variables are often closely interrelated; however, it is difficult to establish causal effects between demographic and non-demographic variables.

Review of literature brings out that the demographic variables that most frequently impact risk perception are age, gender, education, race and ethnicity, and socio-economic status. Other less frequently encountered variables are marital status, household status (such as whether the household has children living in), household size (number of people living in the household), household ownership (owned or rented), location of household (rural or urban), and proximity of risk (mainly related to surface water source).
Age

Chappells et al (2014), in a study conducted in Nova Scotia in Canada on Arsenic risk perception found that the older residents are more likely to have tested for water quality. Chappells’ study also brought out that people of any age with children in the household tend to seek more information and make better use of arsenic risk information.

Among school children, influences on behavior carry influences on attitudes and vice versa. Among adults, conventional strategies of exerting influence such as affect, fear appeal and shame are more effective in achieving influences on behavior than in achieving influences on attitudes. In an action research study in green schools in Israel, Eilam and Trop (2012) found that children were more open to suggestion, and there is tendency that people become less susceptible to influence as they grow older. They also found that children were quick to learn about the behavioral requests for more pro-environmental behaviors.

Griffin and Dunwoody (2000), for a study on awareness of lead poisoning in tap water in Milwaukee, USA gathered information about respondents’ sex, age, race, education, annual household income, property ownership and reliance on different medium for information about lead in drinking water. Correlation of the demographic and media reliance data brought out that younger people do not exhibit strong reliance on any of the information channels and usually make use of multiple sources for information, whereas older people are more likely to rely on newspapers for information.

Gender

Griffin and Dunwoody’s study (2000) mentioned earlier also found that women are more likely than men to rely on television news and newspapers. Likewise, a telephone interview
survey in Midwestern and Northeastern states in the US with women about potential mercury contamination in fish found that risk advisory awareness and information seeking behavior varied significantly by age, race, ethnicity and educational attainments (Anderson, Hanrahan, Smith, Draheim, Kanarek, & Olsen, 2004) within women themselves. In another study to understand Arsenic risk perception in ground and tap water in Wisconsin, Severtson, Baumann, & Brown (2006) found that women had lower personal safety thresholds and perceived worse water quality, and had stronger perceptions about health effects and negative emotions than men. In a study involving two national level surveys, Bord and O’Connor (1997) found that women are significantly more concerned about risks and hazards than men. At the same time, women also perceive more barriers in their ability to act. For women, such action is often a household rather than a personal decision; and others in the household may have different beliefs (Levallois, Grondin, & Gingras, 1999).

**Income and Education**

In the study with 800 random-sample respondents, Savage (1993) found that women and people with lower levels of schooling and income commonly have greater exposure to, and fear of a variety of health hazards. Yet lower status persons are usually less likely to seek professional help to prevent health problems, and they often find that their peers tend not to encourage or reinforce preventive health behaviors. At the same time, in a water quality perception study in Finland, Artell *et al* (2013) found that there was likelihood among people with higher income to underestimate the objective water quality.

Griffin and Dunwoody (2000) found that lower status (low income and education) segments of a community usually acquire knowledge about issues in the news less rapidly than
persons of higher status (high income and education). Lower status persons are less likely than higher status persons to know of steps people can take to overcome the risk. Because they lack this knowledge, lower status persons are also more likely to feel they are at risk from contaminated water. Persons with lower levels of social status are also slightly less likely than those of higher social status to be aware of or suspect contamination in their water, even though they are also more likely to live in areas with higher levels of the hazard.

In a mail-in survey with 545 respondents (private users of wells with arsenic levels exceeding the maximum contaminant level), Severtson and colleagues (2006) found that higher education levels are associated with better utilization of information on well-water risks and prevention, and a worse perception of water quality. They also found that information use had an indirect effect on policy beliefs through understanding environmental causes of arsenic.

**Household ownership**

Dwelling ownership affect the rate of diffusion of information and preventive behaviors (Griffin and Dunwoody, 2000). It was found that since the house owner residents have greater control over decision about which type of water they would choose for their household, they seek more information about tap water contamination, show higher awareness about contamination, and adopt more preventive behaviors.

**Critique of Traditional Approaches and Rationale for Participatory Approaches**

The traditional approaches to risk mitigation, be it financial, health, or environmental risk, essentially follows a knowledge-deficit model and rational actor paradigm. The traditional approach holds that people do not or cannot mitigate risk because they do not know enough about the risk as much as the experts do. Therefore, traditional theories of risk research hold that
the purpose of risk communication is to bridge the gap of knowledge between the laypersons and experts. The theories are also based on the assumption that people will always act rationally, they will always mitigate the perceived (or known) risk, and therefore risk mitigation behavior will always follow knowledge and perception of risk. Public perception of risk has always been dismissed on the grounds of irrationality (Frewer, 2004), and expert-driven persuasive campaigns have always dominated the risk communication initiatives. Such an approach fails to take into account that lay people might not perceive and assess risk in the same way the experts assess the risk, and therefore might not result in the mitigation behavior that is expected by the experts. Risk perception is relative, both in the risk assessors’ situation as well as objective qualities of the hazard itself. Therefore, a blanket risk communication strategy without considering the relative positions of all to whom the communication needs to reach may not bring success. Also, the rational actor paradigm and knowledge deficit model which are underlying assumptions in the dominant understanding of risk perception and mitigation have been contested by many researchers who, through empirical studies found that assessment of risk is complex, situational and expressions of personal value systems (Hansena, Holma, Frewerb, Robinsone & Sandøe, 2003).

One of the greatest delusions in the traditional approaches to risk management, communication and mitigation has been that expert groups consider that their concern will always be echoed by the lay groups. Societal and personal priorities for risk mitigation activities may not align with those identified by expert groups. Also, lack of public engagement in understanding risks that confront communities increase public apprehension of the risk communication and mitigation initiatives. Lack of comprehension of public understanding of risk
and dismissing it as irrelevant and irrational may increase distrust in the motives of regulatory authorities and risk managers such as governments, with consequences of decrease in public confidence in regulatory activities linked to risk mitigation. Risk communication, therefore, needs to be inclusive and respectful to the differences in the target audience. Risk communication must consider the actual concerns of the public, and all intended and unintended consequences of risk mitigation interventions.

Renn (1992) critiqued that the traditional approaches to risk research reduce risk perception and mitigation as individual rational action, and fails to acknowledge both collective social factors and group norms. The quantitative measures taken in studying risk perception factors in most of risk research is too simplistic and contradictory in its epistemological and methodological approaches. Even though the risk theories consider risk perception as individual act, but while measuring risk factors, perceptions are taken in its aggregate, as a frequency distribution or in average mean value through various statistical methods, without accounting for the possible individual situational variations in risk perception. Therefore, risk mitigation based on such aggregate knowledge might not be truly realistic and might not be able to handle all the challenges in risk management.

Discussions in the previous sections demonstrate that risk perception is not a straightforward process, but multidimensional (Renn, 2001). Awareness and understanding of public concerns, priorities and opportunities of mitigation, and barriers must be the basis of an effective risk management strategy, and development of communication and mitigation initiatives.

Review of existing literature on risk perception bring out significant cognizance and
insight on both theoretical understanding and empirical validation of the factors that impact perception of risk by different demographic groups. However, these theories and empirical factors focus primarily on individual factors that are significant and is capable of providing general idea about the factors that impact risk perception. However, none of the theories nor the empirical studies provide a clear understanding of the social, cultural, historical, political, and demographic context of the problem or the people the proposed study will be investigating.

In continuation to Renn’s critique, another critique can be extended that these theories do not attempt to study the intersectionality of these factors and how they interact with each other to impact risk perception. Also, the theories and empirical studies mostly focus on how the risk is perceived and how they are perceived by different individuals, groups or societies, but there is lack of understanding on why risks are perceived the way they are. At the level of data, these approaches may be said to organize what is known, not try to know what is not known, or the underlying reasons of the existence of certain knowledge. Several empirical research studies show that it is hard to differentiate between the impact of social and cultural factors in individual, group or community psychology, and how the psychology in turn impact the way social and cultural practices around risk is perpetuated. It is a two-way process (Paton, 2007). The fundamental argument is individual psychology of risk perception is socially constructed, and without understanding the foundation of this social construction, mitigation cannot be sustainable (Martin, Martin, & Kent, 2009).

The dominant approaches to risk research and the quantitative measures that these theories follow are too elite in their approach, by expecting perfect rationality from people. Interestingly, most of the prevalent risk communication theories are based in the Western
philosophical thoughts and statistical methods, and its tenets are most in context with the population in the west, thus may have limited generalizability and applicability in different social, cultural and economic contexts, such as Global South. Most of the empirical studies based on these theories were also conducted in the Western countries, with different socio-economic, political and cultural contexts. Thus, even though the theories supply the foundational principles of psychology of risk perception, they do not offer much generalizable empirical standards.

Also, the risk perception theories do not adequately address the communication challenges in risk perception and mitigation. Researchers have shown that one of the fundamental reasons for lack of success in risk mitigation efforts is the lack of understanding by the risk managers and experts of the social factors in the constructions of risk, partly due to the dominant paradigm of development and knowledge deficit model that essentially believe that communities would not understand what is good for them and therefore cannot contribute in planning the process of development (Hansen, Holm, Frewer, Robinson & Sandøe, 2003; Chakraborti et al., 2010). Consequently, risk mitigation follows a top-down approach and blanket policies. This not only happens due to the gap in communication between the stakeholders, but also furthers and perpetuates the gap. Such gap can only be bridged through collaborative research between stakeholders, and opening a dialogue between them so that each understand other’s perspectives and challenges, and collaborate to create a solution that’s best suited for the community.

There is an increasing awareness among academic community and national agencies of the suitability of participatory approaches in environmental and health risk research, especially in low-income, multi-ethnic and rural communities in developed countries (Quandt, Arcury, & Pell,
In this section, I discuss three participatory approaches within risk perception and communication research with varying degrees of participatory elements in the philosophical, empirical and methodological approaches. These are Community-based Participatory Research, Culture-Centered Approach, and Mental Models approach. I will discuss the theoretical premises, empirical applications, and challenges of opportunities of these three approaches in risk communication research.

A little discussion of participatory processes is pertinent here, to understand how these three aforementioned approaches fit into the overall approach of participatory research. Participatory research can be of various types and forms- from mere consultation to full control of a project by the people. One of the earliest and significantly influential work on classification of participatory processes can be found in Sherry R Arnstein’s work in *A Ladder of Citizen Participation* (Arnstein, 1969). Arnstein formulated a typology of eight levels of participation, from non-participation to full control. At the bottom of the ladder are (1) Manipulation and (2) Therapy. Arnstein identifies those as non-participation, with full control of decision-making at the hands of those in power. This is the dominant paradigm of development and communication initiatives. Their real objective is not to enable people to participate in planning or

![Figure 1: Arnstein's Eight rungs on the ladder of citizen participation](image-url)
conducting programs, but to enable powerholders to "educate" or "cure" the participants. Levels 3 and 4 progress to "tokenism" in which people hear and also get a voice to be heard. Arnstein identifies those as (3) Informing and (4) Consultation. At this stage, even though they have extended opportunities of participation, and may indeed be heard, but power still resides in the hands of the powerholder who simply “pass on” some power of voice to the people, but not decision-making. Therefore, people lack the power to ensure that their views will actually be heeded. Power is still “given” to people, not mutually practiced. In this level, like the bottom most level, participation is restricted with no follow-through, hence no assurance of change in the status quo. Arnstein identifies another type of participation, (5) Placation, a higher level of tokenism in which people get opportunities to advise, but not the right to decide, which still resides with those in power. At the top of Arnstein’s ladder are levels with increasing degrees of decision-making power in the hands of the people. Citizens and powerholders can form (6) Partnership that enables people to negotiate and engage in decision-making along with traditional power holders. At the uppermost level, people’s participation can take the forms of (7) Delegated Power to people and (8) Citizen Control, wherein people obtain the majority of the power and control of the decision-making process. CBPR, CCA, and Mental Models approach fall into different rungs of Arnsein’s typology.

**CBPR as a Tool in Research on Risk Perception and Communication**

Different accounts of risk research call for mitigation efforts to carefully balance technical scientific efforts, and social mitigation efforts, or ‘western knowledge and local knowledge’, through participatory approaches to create a salient and robust intervention to mitigate environmental hazards and risks in low-income communities (Fiorino, 1990; Mercel et
Public engagement in risk assessment and management encourages stakeholder buy in, taps into unique stakeholder knowledge, and facilitates the practice of environmental democracy (Sexton, 2013). Environmental risk-related decision making needs to seek and incorporate *inputs from stakeholders and the public in order to improve the quality, legitimacy, and capacity of risk-based decisions*, through meaningful participation of the stakeholders in every stage of risk assessment, management and communication (National Research Council, 1989, 1994, 1996, 2009). The interested and affected parties involved in the process of risk characterization *would help formulate problems, provide more knowledge, determine appropriate uses for different analytic techniques, clarify views, and make decisions more acceptable* (National Research Council, 1996, pp.79, italics added).

Participatory approaches emphasize co-creating theoretically grounded spaces of change by working dialogically with communities through participatory communication and decision-making strategies. In case of environmental emergencies, due to collision of scientific information, unscientific misinformation, socio-economic structures and cultural beliefs about health problems emanating from environmental issues, a certain section of the community is marginalized and alienated due to the structure of communication, and thus is seldom touched by the mitigation endeavors (Pal & Dutta, 2013). Participatory approaches ensure that community is involved as participants in both risk assessment, management and communication, and the mitigation efforts include community perspectives- both knowledge, values, beliefs in perception of risk and behavioral intentions and challenges in mitigation of risk.

As a collaborative process of research, Community-based Participatory Research (CBPR)
involves community through participatory methods, in all phases of research—from conceiving the need for a research to dissemination of the learning (Minkler & Wallerstein, 2011; O'Fallon & Dearry, 2002). Participatory approaches create space for communities to negotiate with ‘power-centers’ such as political and economic agencies, to be able to identify, address and redress the community issues and concern themselves. CBPR is both an instrument, a method and a process that can give power to people to identify the factors that can facilitate or impede social change, organize a social movement, to ultimately bring about sustainable social change.

At the theoretical level, CBPR is based on the critiques of Positivist theory, and founded on the principles of Critical theory, Grounded theory and Constructivist theory (Wallerstein & Duran, 2008; Gregg et al., 2010; Minkler & Wallerstein, 2003; Padgett, 2008). Positivist theory holds that reality and truth exists independent of human realization or context, is an impersonal and objective theory that does not consider how realities are influenced and often created by human experiences. Critical theory, on the other hand, postulates that realities are influenced by social, cultural, environmental, and structural milieu of the experiences of people, the relation between inquirer and inquiry is interlinked. Constructivist theory goes as far as to say all realities are determined by the social, cultural, environmental, and structural milieu of the experiences of people, the relation between inquirer and inquiry is inseparable. Grounded theory upholds that theories are founded by the human experiences, that there is no theory without the human experiences (Guba and Lincoln, 1994). These three theories form the basis of CBPR, both as an instrument and process of acquisition of knowledge about communities (Denzin & Lincoln, 2011; Kemmis & McTaggart, 2000).

Involvement of community in all phases of research is both a theoretical and
methodological requirement of CBPR— in problem identification, project conception, fund acquisition, data collection and data dissemination stages. Community needs to be involved with the other stakeholders, such as academic institutions, research agencies, development agencies, or such, as equal partners, and not as mere receivers of some benefits (Minkler, 2005; Israel et al., 2003).

One of the primary aims and goals of CBPR is community empowerment through co-production of knowledge (Balazs & Morello-Frosch, 2013). Knowledge in CBPR is to be built through a participatory process by developing interaction between stakeholders. Stakeholders, irrespective of their relative social, cultural, political and economic position need to be included in the knowledge production process. Inclusion of all stakeholders ensure balanced production of knowledge. Mitigation solutions developed through participatory processes reflect the social, economic and cultural contexts of the community. CBPR also aims to build trust and cooperation between the stakeholders and provide opportunities to every section of a community to voice their perspective—thus bringing everyone in a position of power to alleviate inequalities (Wallerstein & Duran, 2006; Ross, 2010; Castleden et al., 2012).

Participatory approaches explore the complex interplays between structure, culture and agency in the co-creation of transformative practices that challenges the processes that marginalize communicative practices between stakeholders (Springett, 2010, Dutta, 2011) (italics added). The goals of such program of research, as Dutta (2011) elaborates it, are to understand

(a) the location of communication within the complex interplay of structure and culture,

(b) the ways in which individual and collective agencies are enacted within and in
resistance to structural constraints, and (c) the interactions of human agency and communicative processes in bringing about social change and structural transformation.

For example, in the context of the current study, continuous marginalization of the at-risk communities can be discerned by the sheer absence of communication to inform them of the risk that they live under; by the absence of a platform to voice their concern about their perception of risk; and also by the structure (the risk managers) of power-politics in unevenly providing opportunities of risk mitigation to certain people. Therefore, the current study explored the channels of communication that can be created within the current socio-economic and political structure of the communities.

The theoretical premises of participatory approaches provide pragmatic guidelines for engaging with problems of marginalization and disenfranchisement, fostering spaces for listening to those voices that have historically been rendered silent by the institutional practices (Heron & Reason, 1997; Cornwall, 2002; Dutta, 2007). To counter potential clash of knowledge and perspective at the dissemination stage, it is pertinent to involve those who are affected by the problem in the development of communication and information dissemination strategies and plans. Creating a multi-stakeholder communication capable of taking into account local as well as expert knowledge and experience could be of paramount importance for the successful use of any information (Olsson and Berg, 2005).

Theoretical principles of CBPR postulate that communities are essentially plural and heterogeneous entities and is a conglomeration of different social, economic and cultural characteristics from its members- class, race, gender, socio-economic status, age, education, etc. For example, the study was carried out in the district of North 24 Paraganas in southern West
Bengal. Villages in this district are largely homogenous in language and culture, but there exists considerable heterogeneity, such as in terms of social class and caste, religions, socio-economic status, source of livelihood and employment, affiliation to political parties, household income and purchasing power, and availability of sources of drinking water. Even in each individual village, such heterogeneity exists. Any programmatic intervention needs to cater to these variations in the community, and accordingly be inclusive both in planning and execution. (Cooke & Kothari, 2001). The hybrid nature of participating community members may result in conflicting voices. For example, in risk mitigation of Arsenic contamination, these interests may reflect tangible contextual needs and challenges such as amount of water needed every day, distance of the household from safe water-point, availability of family members for fetching water, financial limitations; but may also include more individualistic interests such as desire for power (by individuals or political entities), desire for convenience (accessibility of the water-point near one’s house), local inter-organizational feuds (such as between the Public health departments, local self-government entities, religious institutions and political parties).

Production of knowledge through collaborative processes has often relied on an uncritical participation of actors and on the ability of this knowledge to become part of the community’s agendas. Likewise, to best serve all conflicting needs and interests, therefore conflicting interests should be judged based on ethical, rather than critical criteria. Such criteria often imply that results are considered valid (true) if usable in practice (Mantoura & Potvin, 2013) for the greater good of the greatest number of people in a community. Despite greatest efforts at including all the conflicting voices in participatory research, some voices may still remain unheard and some ethical interests may not be served well.
Credibility of information about the risk is another factor to increase apt risk perception by the communities. A community decides who and what they think are credible sources of information based on their unique socio-cultural backgrounds and contextual experiences. Researchers often grapple with such challenges. For example, in a study by Scammell and colleagues (2009) on public perceptions of community environmental health studies, in a community in Boston with long history of environmental health issues, data from three focus groups revealed that participants found it difficult to accept the empirical information from the studies about risks that contradicted their own experiences of environmental exposures and illness. Community’s knowledge is informed and shaped by their different experiences with “tangible evidence” which “creates a lens” for the communities to interpret information. Participatory processes in co-creation of knowledge and communication can help to mitigate this challenge in communication.

Bessette (2004) observes that there is no magic formula on how community can be involved. There is no single, all-purpose recipe to initiate a participatory development communication process. For each different community, the approach needs to be unique. Communication practitioners need to look for the best way to establish the communication process among different community groups and stakeholders, and use it to facilitate and support participation in a concrete initiative or experimentation driven by a community to promote change (Bessette, 2004). Bessette maintains that community participation in the selection of issues of importance, development of messages, and choice of media for message dissemination is crucial to create community buy-in. The non-tangible nature of environmental problems makes it difficult for issue identification and risk perception. Prior community engagement and
collaboration will build awareness of the issues with the community, and bring out the challenges in perception.

Community-based participatory studies with different environmental justice communities reveal the need to foster trust and communication in order to execute culturally competent and relevant research projects (Latowsky, 2003; Viswanathan et al. 2004; Stratford et al., 2003). Involving and engaging a community in crucial decision making is necessary to evolve an ‘adaptive environmental management framework’ (Arvai et al., 2006), and co-production of knowledge contribute to more technically sound science, democratically accountable policy and culturally appropriate information and dissemination (Corburn, 2006).

Viswanathan and colleagues carried out an extensive review of articles written from CBPR studies from around the United States. Their study evaluated community involvement in research process and highlighted strategies of successful models of community involvement that have resulted in better stakeholder partnerships, policy changes and risk mitigation (Viswanathan, Ammerman & Eng, 2004). There are multiple ways community involvement in the CBPR projects has worked. Community involvement has been noted in issue identification; defining and development of research agenda; research design, development and implementation; research instrument development, field-testing, and implementation; proposal development for funding and actual funding (Institute of Medicine, 1988; Cassel, 1976; Israel et al., 1989; Wagenaar et al., 1994; Stevens & Hall, 1998; McCauley et al., 2001; Stratford et al., 2003; Wing & Wolf, 2000; Vander Stoep et al., 1999; Sloane et al., 2003; Parsons & Warner-Robbins, 2002; Choudhry et al., 2002). The idea is to create a research agenda with and by the community, not on the community. Several CBPR studies note that the process of building
partnerships between institutions and communities is lengthy but very rewarding, since the strength of the partnership determines the involvement of the community in the project, during the running of the project and afterwards (Israel et al., 1989; Wagenaar et al., 1994; Stevens & Hall, 1998). Building community partnerships using evidence based baseline data through need assessment surveys are effective means to understand community perception and generate interest among community members (Institute of Medicine, 1988; Stratford et al., 2003). The most involved community participation is noted in projects when community leadership themselves approach research institutions to initiate the proposal based on community's priorities and desire for research (Stevens & Hall, 1998; Cummins et al.; 2010; Viswanathan et al, 2004). Many studies mention that involving the community to set research priorities and identify key research questions increase the likelihood that the research reflects what the community needs and wants (Israel et al., 1998; Viswanathan et al, 2004). Involvement of community in developing research instruments and field-testing of the instruments increases the cultural appropriateness of the instruments and increases the likelihood that study participants will be able to relate to those (Schensul et al, 2006). One of most effective community involvement has been in the study design and implementation, in recruiting and participant retention (Yancey et al., 2006; Horowitz et al, 2009). Engagement of community members in administering surveys and conduct interviews generally increase participation rates as these survey helpers speak the language of the community (Wing & Wolf, 2000; Sloane et al, 2003).

If the CBPR includes an intervention, community participation in the intervention planning, design and implementation increases the likelihood that the intervention appropriately responds to the need of the community (Minkler & Wallerstein, 2011).
One of the least participated areas by the communities is proposal development and fund management, unless the projects have been originally conceived by the communities. Most often researchers take lead in proposal development. Community involvement in proposal development is not rare, and it is found to increase community buy-in (McCauley et al., 2001; Stratford et al., 2003). Community participates in the advisory committees, partnership steering committees with community partners as equal partners. Community involvement in acquisition of additional grants for further research or to generate local funding is found to be an effective way to maintain sustainability of the programs beyond the immediate timeline of research and intervention (Stoep et al., 1999; Sloane et al., 2003). Community participation in the data interpretation is another area where community involvement has been limited and remains understudied (Viswanathan et al., 2004). However, involvement of the communities in implementing research findings through policy changes and change in private institutions or at local levels through the efforts of community collaborators has been documented (Parsons & Warner-Robbins, 2002; Choudhry et al., 2002).

With careful planning for community engagement and empowerment, issues of contamination risk can be mitigated gradually and in a phased manner (Frandsen et al., 2011; Chandra et al., 2011). The analysis of risk situations involving scientific evaluation of a hazard or risk and participatory public communications can provide an effective approach in managing environmental risks (Amendola, 2001). Quinn (2008) observes, “...risk communication will be strengthened if strategies encourage a dialogue among members of the community about risks and how to best use resources and information to address the consequences” (italics added). Communication strategies and content that come out of engaged and empowered community
participation acknowledge individual beliefs and community norms that shape perceptions and expectations of what is to be done to mitigate risks, rely on diversity of mode and content as well as ability to link social networks effectively, and takes care that the underlying literacy, particularly health literacy, of the community supports its ability to process messages, take action, and plan for recovery. Kuruppu, 2009; Chandra et al, 2010). These strategies ensure a “Community-First” communication model that generates workable solutions to the problem investigated, increases community awareness and facilitates positive behavior change (Emmett et al., 2009).

Culture-centered Approach in Risk Research

participatory research approaches follow a continuum, wherein levels of participation ranges from mere consultation with the community to full control in decision-making, as expanded in Arnstein’s typology stated earlier. Level of involvement may also be varied, from involvement of communities only in data collection and dissemination of results, to total participation by communities from research design to dissemination of results. By doing that, the end product of CBPR, be it intervention or mere understanding of an issue, almost always considers the cultural experiences of the community members, and attempts to weave in those cultural nuances in the intervention. Thus, CBPR essentially produces culture-sensitive communication, but this does not ensure that CBPR inevitably advances culture-centered communication. This presents yet another continuum in participatory research. A culture-sensitive communication may still push the agenda of the powerholders to maintain the status quo, and may merely adapt communication to include cultural markers of the community. Such message is still not representative of the community, and perceives culture as a static entity,
much different from the dynamicity culture represents in reality.

However, in all probability, the fundamental goal of any community-based participatory research, especially those aiming at risk management is to introduce community voices in the research and mitigation processes. CCA holds the same fundamental goal and advances it further, by attempting to disrupt the dominant discourses with alternative voices from the marginalized communities. To this end, CCA aims to bring about sustainable social change.

Traditional communication processes create perpetual inequalities in the society by denying voice to people in the margins. The distributions of communicative infrastructures map out the inequities in distributions of economic resources, reifying the unequal distribution of resources by perpetuating values embedded in the interests of the power elite (Dutta, Anaele & Jones, 2013 italics added). Exposure to health and environmental risks are also result and extension of these inequalities in economic resources and communicative opportunities. Disparities in natural resource allocation also determine the allocation of risk that may arise from use of these natural resources. To ensure that communities are not only heard but heeded to, the existing inequalities need to be questioned, and the social structures and communication infrastructure need to be changed by creating spaces for marginalized voices through dialogue with the participants. Such an approach keeps culture and everyday lived experiences of the participants at the heart of this dialogic process, and attempts to understand the experiences in the light of community’s culture, which contribute in construction of those experiences. The culture-centered approach, is not only interested in the ways the marginalized identities are shaped, repeated, and continued, but also seeks to disturb the dominant paradigm of communication by presenting opportunities for inclusion of the marginalized voices in the discursive space (Dutta & Basnyat, 2008; Dutta-
Bergman, 2004, 2005). Research with Culture-Centered Approach (CCA) locates the root of marginalization in communication and role of communication in marginalization, explores the ways in which cultural meanings are co-constructed by the cultural participants through their interactions with the structure in which they live, and discovers possibilities to bring social change. These possibilities are frequently created by participatory processes of dialogues and communication such as ethnography, survey-based methodology and performance to engage with the symbolic and material spaces of social change. In this sense, culture-centered approach serves to represent community-based participatory research both theoretically and methodologically.

The culture-centered approach to health communication serves this agenda by highlighting the voices of cultural participants (Dutta & Basu, 2007a; Ford & Yep, 2003). In this approach, cultural contexts are placed at the core of meaning-making processes, and meanings are dialogically co-constructed by researchers and cultural participants. CCA steps away from the traditional linear message transmission model by accentuating the voices of the marginalized, by acknowledging the cultural participants and by advancing community participation as the foundation for developing interpretive frameworks in communication applications (Dutta & Basu, 2007b). Voice of the community is central in CCA, which the dialogic processes aim to facilitate and magnify, and ultimately enable structural transformation to erase inequalities.

CCA is made of three interdependent constituents. These are structure (implicit or explicit configurations of societal resource access), culture (meaning, interpretation), and agency (explicit capability of independent choices by marginalized individuals and groups in negotiating structural conditions). It holds culture as central, not peripheral, and as the context which shapes
and defines all human activities. Therefore, to effect any change in the structure, individuals
must understand self within its cultural context, and develop a sense of personal and collective
agency, which the participatory and dialogic processes of CCA aims to facilitate.

Methodologically, by considering culture as the context of human activities, CCA
requires itself to be a community-based approach. Else, cultural contexts cannot be fully
understood, and only cultural markers can be highlighted without accounting for the cultural
variations. Therefore, CCA is integrally situated within the community-based participatory
research approach, however the reverse might not always be true.

*Mental Models Approach*

Mental models approach represents another continuum in the participatory research
approaches. Mental models research in risk communication tries to bridge the gap between the
elite expert-driven models of risk research theories and community-driven participatory research
and calls for an engaged understanding of various social-cultural factors that affect community
members and a community’s shared knowledge and perception about environmental issues.
These are often so embedded in the daily lives of community members that they themselves are
unaware of these knowledge and perceptions. Such interconnectedness of inner perceptual
schemas can only truly be understood through in-depth interviews and other participatory
methods. These inner perceptual schemas are mental models which develop in the course of our
interaction with our surrounding.

Granger Morgan and colleagues (2001) used the mental models approach in risk
communication research to understand and mitigate risk from a multidimensional perspective.
The authors start their pioneering book, *Risk Communication: A Mental Models Approach*
(2001) by elaborating several problems with the existing research on risk communication, and aimed to bridge the gap in risk communication research by introducing participatory processes and involving both experts and laypeople in the risk identification process. The dominant paradigm of risk communication research perceives laypeople or the consumers as technically illiterate and makes decisions based on emotion rather than knowledge, common people neither have the time nor the technical knowhow to understand the technical specifics of the risks. Therefore, it is better that risk communication is developed solely by the experts with information what the experts think are important for them. Morgan and colleagues however perceived that emotions make the people critical consumers of information and they do better in processing information. Also, traditional ways of risk communication have long been criticized for being manipulative, top-down and one-way communication that follows a typical simplistic communication model wherein the experts are the sender of the messages and laypeople are passive receivers. Unfortunately, when a communication is failed, the blame of this fail invariably and inevitably goes to the receiver of the message, not the message itself. Morgan and colleagues’ use of mental models aimed to break that stereotypical ways of risk communication to provide a balanced way of developing risk communication materials, with assumption that the obstacle in understanding risk communication is time and attention, and intelligence. Their use of mental models is both theoretical and methodological, as they argue that designing such risk communication must start with the examination of the choices people face, beliefs they hold and experts’ relevant knowledge and understanding of what people know and how they should be further informed. They postulate this understanding can be developed by eliciting deep mental models that both laypersons and experts have about the risk.
Even though the approach was first used by Morgan and colleagues for risk communication research, mental models research has been going on for more than a century in cognitive psychology. Mental models as inner perceptual schema was first postulated by Charles Sanders Pierce in 1896 who discerned it as the internal representations of external realities and envisaged as small-scale versions of those realities. Mental models are dynamic, incomplete, inaccurate cognitive representations. They are perceptual and experiential, and start developing in our mind from early childhood (Pierce, 1896; Johnson-Laird, 1983; Halford, 2014).

While the cognitive psychologists and system dynamic theorists have postulated mental models largely as an individualistic thought process (Burge, 1979; Markus & Kitayama, 1991), cognitive anthropologists postulate that mental models have shared, cultural and collective nature (D'Andrade & Strauss, 1992; Denzau & North, 1994; Harrison & Huntington, 2000). Mental models are formulated by prior knowledge and perception, and evoked by a situation in which logical reasoning is required. The process of acquiring knowledge and the knowledge itself, the perceptual schema and also the process of reasoning is frequently impacted by the social and cultural contexts of the reasoner’s life. Different people from the same or similar social and cultural contexts are therefore likely to share the mental models as well.

D’Andrade and Strauss perceived that mental models have an anthropological origin. They use the word ‘moral models’ and ‘cultural models’, and uphold that models are set of cognitive elements used to understand and reason human motivation for action (D’Andrade and Strauss, 1992). In their seminal work Human Motives and Cultural Models, D’Andrade and Strauss (1992) argue that to understand “why people do what they do”, one needs to understand the underlying nature of human motivation. Human motivation is an outcome of interaction
between events and things in one’s social world, and interpretation of those events in human psyche. They argue that “models of human motivation need to reject not only psychobiological determinism but also sociocultural determinism” (Strauss, 1992). Contrary to both psychological and social-cultural theories, human motivations are neither fully dependent on the psychological constructs nor on cultural constructs, but a combination of both. Throughout their book, they bring out that human motivation depends on cultural constructs and is realized in social interactions, but at the same time motivation is not automatically acquired when cultural messages have been imparted (italics added) but go through elaborate cognitive processes in the human mind and create cultural models for future references (D’Andrade and Strauss, 1992).

Many of our mental processes used in interpreting the world work as functions and goals. These mental processes or the cognitive schemas are largely both learned and widely shared in the cultural settings. Schemas are embedded in culture and therefore easily accommodate the variations in cultures. Variations within the cultures directs attention towards the processes by which cultural models are internalized. The mental processes are influenced by socialization experiences, and various social, political and economic factors as well. The interaction of these factors with the psyche create certain cultural models which are references while making sense of external realities (Markus & Kitayama, 1991; D’Andrade and Strauss, 1992; Denzau & North, 1994; Vosniadou, 1994).

Mental models have widely been used as a cognitive model to understand why people perceive and behave in a certain way in certain situations, and predict how humans will make decisions about certain things. Mental models have found significant importance in environmental risk perception, communication and management research (Morgan, Fischhoff,
Bostrom, & Atman, 2002; Zaksek & Arvai, 2004; Leiserowitz, 2006; Jones, Ross, Lynam, Perez & Leitch, 2011). Research shows that cultural practices, meanings, beliefs and “epistemological orientations affect memory organization, ecological reasoning, and the perceived role of humans in nature” (Bang, Medin & Atran, 2007, italics added). Therefore, understanding cognition, knowledge and attitude about environment is crucial to understand the basis of human behavior towards environment and natural resources.

Mental models are representative symbols of what is perceived in the real world. This makes it difficult to form clear mental models of many environmental systems, especially impending dangers or invisible contamination as they are not perceived easily, and are often temporally and spatially distant (Johnson-Laird, 1989; Liberman et al., 2002; Liberman et al., 2007; Spence et al., 2012). Also, systems dynamics researchers draw attention to peoples’ cognitive limitations in terms of processing information feedback, particularly when there are long time delays between action and response (Sterman, 1994). Computer-based controlled experiments show that people’s mental models demonstrate a limited capacity to take account of feedback delays and the side effects of decisions made. These characteristics of cognition of environmental systems make it interesting to understand the mental models of environment.

Mental models researchers have found large scale misconceptions among laypersons about the environment, especially those pertaining to climate change and global warming (Bostrom et al., 1994; Read et al., 1994). They found that individuals often mix two concepts of complex environmental systems, and create new mental models associating new information with pre-existing mental models, without checking the scientific validity of such association. It is crucial in case of environmental concepts as with these misconceptions, people then behave
erroneously and support inappropriate environmental policies (Leiserowitz, 2005).

Lowe and Lorenzoni’s empirical study on risks of climate change with 22 expert scientists from diverse field brings out two important aspects of mental models: (1) that in spite of specialized knowledge about climate change and complex system of the environment, decisions about climate change are molded by the knowledge and perception of the issue, and therefore different solutions are proposed; (2) these differences justify the different individual and institutional responses to climate change. This also shows that even the experts have varied views about subjects that they have high objective knowledge and exposure. Experts emphasize and expand upon different elements according to their expertise, background and views of environmental risks (Lowe and Lorenzoni, 2007). The diversity and context specificity of risk perception are apparent throughout, both among experts and laypersons. (Wynne, 1996; Oppenheimer, 2005; Lorenzoni et al., 2005; Lowe and Lorenzoni, 2007; Pidgeon, 2008). Therefore, to develop strategies for mitigation of risk, a collective understanding of experts’ and laypersons’ views are important.

Stone-Jovicich and colleagues (2011) used consensus analysis to understand shared cultural models of water use by communities. Consensus analysis, a technique frequently used in anthropology uses the concepts found in mental models from a collective standpoint. Consensus analysis perceives culture as knowledge shared by a group. The underlying postulation is that cultural values are “systems of knowledge” that together denote a “single conceptual domain individuals use to interpret and respond to the world of experience” (Weller and Romney 1988, Handwerker 1998) are collectively and generationally generated, learned and shared.

Given the continuous shift in the mandates and priorities of the stakeholders and
institutions, social learning is the primary aim of the most programs in natural resource management (Pretty 2003). From the perspectives of natural resource management, especially pertaining to water, land and forest management, coordination between the diverse views of the stakeholders is a challenge. Also, the lack of opportunities for dialogue on how to share a representation of the functioning of the management system and lack of opportunities for collective learning is an issue (Ravnborg & Westermann, 2002; Pero & Smith, 2006). These all point towards the need for identifying shared mental models and facilitating social learning processes. Social learning process “can be characterized by its members being involved in a process of collaboratively conducted, collectively accountable change directed towards shared aims, values or principles” which is the ultimate aim of natural resource management programs (Watkins and Marsick 1992; Schusler et al., 2003; Leys & Vanclay, 2011).

Zaksek and Arvai (2004) identified that mental models research determines the unique information and decision-making needs of stakeholders to facilitate a two-way communication between stakeholders such as information managers, policy makers and end users in natural resource management contexts. Several authors have identified this crucial importance of mental models research in learning stakeholder perspectives, gap in knowledge and understanding between ‘experts’ and ‘laypersons’ (Morgan et al., 2002). Environmental risks, however certain and urgent for experts, is often ambiguous and full of uncertainty for laypersons (Kunreuther, 2002; Johnson & Slovic, 1998), therefore participatory processes will create opportunities to clear up these doubts, and trust issues.

Mental models can be the basis of participatory information and communication campaigns. Even though there may be resistance to information in case of crisis and risk of
hazard, if the information is linked to preexisting mental models and cognitive maps, there is higher likelihood of the information being understood and accepted (National Research Council, 2000). Also in system dynamics research, mental models facilitate understanding of complex system from a layperson’s point of view which is otherwise difficult to comprehend. By determining the causal connections between the complex systems, mental models can facilitate development of information keeping in mind the existing knowledge and perception of the system (Doyle and Ford, 1998).

Morgan’s mental models approach attempts to be both expert-driven and inclusive, and opens a discussion on the need and opportunities for truly participatory process in risk research. In Arnstein’s typology, Morgan’s mental models will probably fit in as Consultation or Placation, as even though it provides opportunities for people to hear and be heard, but primarily to inform the risk manager and regulators to be better informed of people’s conditions, and not so much to provide them any decision-making control. When used as a method, the study instruments of mental model interviews are largely developed by experts or risk managers; whereas data is collected through in-depth interviews to elicit inner understanding of risk perception by people. Since mental models research is done at the locations of the research respondents and elicits responses in respondents’ social, cultural, political and structural contexts, it may provide adequate opportunities for multi-stakeholder engagement if planned accordingly. Especially in complex environmental management issues in which both problem and management are shared concerns of a community, creating a social management plan inclusive of the diversity of all the stakeholders’ ‘perception, goals and values’ is not possible without first understanding the individual collective mental models of the ecological issues.
(Pretty 2003, ComMod 2006). This creates an opportunity for use of mental models both as a theory and as a method in a community-based participatory study.

**The Continuum of Participatory Research**

This dissertation combines theoretical and methodological elements of these three approaches in a unique manner. Mental models and culture centered approach can be perceived as two levels of community participation in a community-based participatory process. Even though the epistemological and philosophical foundations are different in these two approaches, both strive to include community voice in identification of issue and data collection, while trying to find solutions to a chronic issue. While the former might just be another form of culture-sensitive approach, it is a degree in fully realizing the potential of culture-centered approach.

Culture-centered approach provides the theoretical foundation for this dissertation. The fundamental goal of this dissertation is to disrupt the dominant ways risk has been understood and mitigated by both risk managers and at-risk communities, and affect social change by introducing alternative voices from all those who are involved in this process. Social change is often measured materially: through quantifiable measures of actual change in personal risk mitigation behaviors. But social change cannot always be quantifiably measured, especially at the onset of the process of social change. In this dissertation, social change is perceived and measured symbolically. Culture-centered approach disrupts the dominant discourses about risk and, rupturing dominant discourses about an issue, and opening spaces for alternative voices is itself a measure of social change. These alternative discourses may lead the way for future social action, and bring about more ‘materially measurable’ social change (emphasis added).

Participatory research is both a philosophy, an ideology, a theory and a method- it strives
for community empowerment through community engagement in all stages of research and dissemination. Mental models for risk research has primarily been conducted to inform and prepare risk managers and risk communicators to *translate scientific research into persuasive communication* materials to *convince communities* for behavior change. Even though the primary purpose and outcome of mental models study is not community empowerment; the actual process of mental models study is participatory. Even though community respondents’ mental models are collected to *verify* those with that of experts’ models, the actual process provides absolute freedom to the respondents to share their perceptions. In addition, even though community is not necessarily provided opportunities to actually design any solutions to the issue they face and power is still in the hands of traditional powerholders, community perspective is included in risk management plans, to ensure community acceptance. There are multiple opportunities for a mental models study to be participatory, both in process and outcome. Both mental models and CCA strive to understand the inner understanding and perception of the issue from the point of view of all stakeholders, and bring both researchers and community face-to-face with each other.

Both mental models and CCA are theory and method. For risk research, while mental models help gather the inner psychological/cognitive perceptions of risk, CCA helps understand those in the context of the socio-cultural contexts and structures. Being situated in the community during the research process is useful to understand the contexts and hidden meanings, and both approaches facilitate that process.

CCA and CBPR share crucial commonalities as both CCA and CBPR projects are traditionally done with an immersive role of the community in the research process, as partners.
and co-creator in the research process, research tools and analysis of the collected data. These approaches often involve joint advisory boards, and various other consultative methods between community and researcher’s institution to bring a community centered point of view to solving community prioritized and characterized issues.

CCA and CBPR complement each other not only in theory and practice, but also in methods of collecting data. Both CCA and CBPR are typically done through ethnography. A slight difference between CBPR and CCA might be noted here. While fundamental premise of CBPR is to represent and amplify community’s voices and change mainstream understanding of an issue with community’s voice, CBPR may or may not chose a critical stance, and may just chronicle community voices. However, CCA is always based on a critical approach, and critically evaluates both the contexts of the issue and community’s voices, to understand the issue from structural, cultural and agentic points of view. At the level of data collection and data analysis, this is often achieved through the use of critical ethnography. For this dissertation, I have used critical ethnography as the method through which I apply the principles of CBPR and CCA. Naidoo defines ethnography as:

...a qualitative methodology that lends itself to the study of the beliefs, social interactions, and behaviours of small societies, involving participation and observation over a period of time, and the interpretation of the data collected. (Naidoo, 2012).

Critical ethnography goes further than just describing people and culture, but includes participation of those being studied and the cultural significance of the actions described (Denzin and Lincoln, 2011), and analyses those interactions as discursive exchanges between the researcher and the researched. Meanings are thus mutually created, and identifies the seeds of
power and powerlessness in the society Reeves, Kuper and Hodges, 2008). From this perspective, it becomes an integral part of CBPR, CCA and mental models study, as the qualitative data collection is participatory in nature and in alignment with CBPR and mental models study; the premise of critical analysis shares a mutual interest and aim with CCA.

Critical ethnography has been subject of multiple criticisms. It has been accused of subjectivity and imperfections of the researcher, restrictive influences of personal discourses of participants and the researcher, the paramount importance given to context, and ethical considerations whether the data analysis truly represent what the participants said or whether the data represent what the researcher thought participants said. Rudkin (2002) observes that the strengths of critical ethnography as a research methodology outweighs these limitations. Critical ethnography simply is not a research methodology for every research study. In fact, every qualitative study cannot amount to be a critical ethnographic study. The paramount impact of the context is the strength and pillar of a critical study, and therefore enriches both the research process and the data thus ‘generated’. Critical ethnography is a value and ideology based research method, and identifies the contextual processes in which power, powerlessness, and autonomy reside in the hands of different segments of the communities. It is this strength of critical ethnography that adds special value as the chosen method in this dissertation.

The next chapter on Methods and Methodology provides a more detailed description of the elements and particular techniques of critical ethnography that was used for this dissertation.

**Purpose, need and scope of the Study**

Community-based participatory research, implemented through mental models research and CCA, are particularly useful for risk issues which are complex, multidimensional, have long
been understood and studied through alternative approaches and need multi-stakeholder participatory involvement in mitigation. Arsenic contamination of groundwater in Bengal basin is one such issue which needs understanding of the issue and the affected community from a variety of perspectives- historical, social, cultural, political, and economical. With some 78 million consumers of contaminated water being at risk of adverse effects on their health, and approximately 22% of them with high probability to die of an Arsenic-induced disease, it is one of the worst cases of chronic groundwater contamination.

Risk mitigation has been challenged by multiple reasons, many of those have been identified to be socio-cultural and political factors. While socio-cultural factors affect cognitive abilities of risk perception and attitudes towards perceived risk; difficulties in water management and development of alternative sources of water have been hindered by social, cultural, political and economic reasons. Investigation of prior mitigation attempts highlights lack of success in promoting Arsenic-safe water habits and communicative challenges of interventions at the household and social levels. Experts-driven interventions fail due to lack of continuous community engagement, regular feedback between mitigation team & at-risk groups, poor economic condition and low literacy rates that widen the communication gaps further complicating the situation.

Alternative sources of procuring drinking water, such as rivers is limited due to high pollution. The situation is worsened by the political tensions between India and Bangladesh regarding sharing of water of river Ganges. India and Bangladesh signed the cross-border Water Treaty in 1975 which resulted in building of Farakka barrage over Ganges, the main source of water in the Bengal Basin (southern West Bengal and Bangladesh). Political debates exist that
Farakka barrage not only restricted the flow of water to lower Bengal Basin, especially to Bangladesh (known as Padma), but India has also been accused of over drawing of water from the Barrage, resulting in more silt in the lower Ganges basin, drawing of groundwater in higher rate than that of recharge, reliance on groundwater for both drinking, agriculture, and irrigation during dry seasons, leading to arsenic contamination due to oxygen deficiency and aeration of arsenopyrites buried in the sediment that remained under water prior to construction of the Farakka Barrage. For mitigation of the existing contamination and to prevent future contamination, it is also said that the water tables in the lower Bengal basin need to be restored to pre-1975 levels.

Given the complex nature of the problem, any intervention to mitigate Arsenic contamination in the Bengal basin needs to happen at multiple levels: at the micro level of water users, and at the macro policy level of water regulators and scientific experts. On one hand, socio-cultural factors impact communities’ perception of risk, attitude towards perceived risk, and personal risk mitigation behaviors, on the other hand, limited opportunities for water management issues not only has limited the scope of mitigation interventions, but also has caused a kind of fatalism among people which in turn has serious repercussions on mitigation interventions.

Due to the multidimensionality and chronic nature of the issue, the issue also has to be understood from all the dimensions to fully comprehend the risk and suggest any mitigation plans. Towards that end, the current study attempted to understand the historical, political, social and cultural factors of Arsenic contamination of groundwater in Bengal Basin, both as independent factors and the intersectionality of these factors in relation to each other.
Risk mitigation needs to engage various stakeholders (communities, researchers, scientists and policy-makers) in dialogues with each other, to identify the multitude of the risk, and mutually identify the critical solutions. Such mitigation is only possible by employing theories and methods that has potential to understand this complex multidimensionality. Participatory approach is capable of developing such dialogue among various stakeholders, and understand the risk, challenges and opportunities from a multi-stakeholder perspective.

Specific Conceptual Areas

The current study built on these general theoretical foundations of culture-centered approach and participatory research that risk perception needs to be understood in the contexts of the people living in the contaminated locations, within the structural, cultural, historical and political background which impacts their everyday lived experiences and develop strong mental models about contamination and people’s personal agency of mitigation. The current study focused not only on the individuals as the unit of analysis, but on the collective nature of the issue with the understanding that the structural and cultural factors affect perception of risk, attitude towards perceived risk, and risk mitigation opportunities and behaviors. The uniqueness of this study lies in the fact that the study sought to understand the impacting factors in relation to each other, in order to get a holistic picture of not only what mental models exist of the risk and mitigation, but also how and why those mental models came to be. Further, it sought to understand how the structural barriers can be overcome to mitigate the risk from a communal point of view.

The current study was based on multiple forms of participatory research- both mental models and CCA provide opportunities for participatory data collection. CCA process starts with identifying the issue as seen by those who have traditionally not been heard and heeded to and
opens a dialogue so that the issue is also understood from the margins. In the current study, those who are traditionally considered as experts can also be in the margins, due to their unaware of the community perspectives and challenges in mitigation. It then critiqued the existing approaches to mitigation of the issue, and infrastructure that impeded the mitigation. This was done with participatory processes of data collection, such as in-depth ethnographic interviews at the location of the stakeholders with the aim to bring out the deepest mental models of the issue. Even though mental models are individual perceptions, but they are constructed and impacted by the social and cultural contexts. The current study was based on the principles of mental models as perceived by the cognitive anthropologists which essentially holds mental models as having shared and cultural characteristics between members of culture groups. While the shared mental models approach help bring out the individual and collective mental models of risk perception, CCA approach help communicate with and between stakeholders so that they understand each other better, to facilitate not only improved communication, but also mitigation. This iterative process is empowering for all stakeholders and will provide opportunities for bringing all of them into a common ground in which all understand the challenges each face and work collaboratively to find a workable solution to mitigate the issue which is long-term, sustainable and of greatest good to the greatest number of people.

Research Questions

The current study sought to answer five key research questions:

Given that risk perception is an outcome of social, cultural and political and historical context of the stakeholders, and therefore are shared

RQ1. What is people’s perception of the contamination?

RQ2. How do historical, social, cultural and political context factors impact people’s
perception of the contamination?

Given that participatory and collaborative approaches to risk identification build stakeholder capacity towards risk identification and mitigation

RQ3. What is experts’ understanding of people’s perception of risk and the factors that impact those?

Given that risk mitigation efforts may be more effective if facilitated at the communal level, rather than just at an individual level

RQ4. How can the learning from the study be provided to ensure higher community buy-in and better risk mitigation?

RQ5. What structural and functional changes can be made to the communication and mitigation to ensure sustainable mitigation of the risk?

Scope and limitations

The current study is based on Cummins and colleagues’ (2011) creative designs of engaging the community in a collaborative manner, taking into consideration:

“(a) the community's extensive knowledge of the local environment, environmental degradation and potentially related human health issues; (b) the community's traditional respect for and relationship to the land and water; (c) the community's need for data to answer local questions; (d) Western scientific knowledge of environmental health and of risk assessment methodology; (e) what research is valuable to other rural or minority communities”.

Being a dissertation study, the study is bound by limited time and resources. Therefore, all stages of a true and full-fledged community-based mental models and CCA study could not be fully adopted. This study strives to fully incorporate the theoretical principles of participatory
research as practiced in mental models and CCA, so even though the initial background research was done by the researcher, but both experts and community members were involved in the process to guide the researcher with contextualizing the study instruments, finding the at-risk villages and identifying potential participants, based on the initial criteria developed by the researcher. The scope of the study is not to suggest large changes that might need extensive political or economic intervention, but to bridge the communication gap between experts and villagers, to inform about the risk perception and mitigation challenges each group faces. The study intended to rapture the dominant practices of risk communication. It provided a space for the communities to voice their own perceptions of the risk and challenges in risk perception. Even though the study did not involve action-oriented change-making, one of the common parameters of a CCA study, but the perspectives shared by the stakeholders might form basis for future intervention for risk mitigation. This study was one of the first social-scientific endeavors in Southern West Bengal, to understand Arsenic contamination risk perception from multi-stakeholder perspective.

Summary

The current chapter provided an account of both theoretical and empirical, dominant and discursive approaches to risk perception, communication, and mitigation. As discussed in the chapter, while the traditional approaches to study risk perception have its own merits of understanding the psychological contexts of risk perception and mitigation behavior, they do not take into account the intersectionality of the social, cultural, economic, political and contextual factors that form the psychological constructs of risk. Empirical research also shows evidences that risk perception is socially constructed, and therefore it is imperative that those factors are
taken into consideration to understand issues with risk perception and mitigation. Mental models and culture-centered approach provide a more open and participatory ways of eliciting mental constructs of risk, and do so within the intersectionality of contexts the participants are in. By doing so, these research approaches also facilitate community empowerment. Engagement of community in different phases of the research enriches the research process and outcome.

*Preview of next chapter*

Next chapter elaborates on the philosophical and epistemological foundations of the study, along with the reasons for those choices. The chapter begins with the social, cultural and contextual background and consequences of the Arsenic contamination issue in southern West Bengal. It then elaborates the specific methods, data collection and analysis and how the methodological choices reflected that context. It also elaborates on the positionality of the researcher and how different choices made before and during the research was influenced and shaped by that positionality.
CHAPTER 3 | METHODOLOGY AND METHODS

From a discursive perspective, the methods one employs are inherently bound up with theory. The choice of how to investigate a given topic is intimately connected with epistemological and ontological issues relating to the very nature of that topic as a ‘topic’.

Silverman, 2010

Communication as an academic discipline situates itself in a multi and transdisciplinary space. Due to this multidisciplinary nature, it borrows and converges methods from different academic disciplines and theoretical schools (Höijer, 2008). Underlying the methods, there are diverse possibilities around the nature of truth, nature of knowledge and how to gain knowledge. In this section, I go deep into how the theories that I explained in the previous chapter ties closely with the methodological choices in the research, both philosophically and pragmatically, how my own positionality affected my choices, how I went about gathering data from different sources, how I analyzed the data, and how I perceive I will ensure trustworthiness of the research.

In the previous chapter, I explained that the dominant approaches to study risk communication focus on the individual psychological constructs and rigid cultural constructs, and have been met with skepticisms, both on theoretical and methodological premises. These theories perceive that risk perception and behavior necessarily follows rational choice, and do not adequately address the social constructionism in risk perception, resultant risk behavior, and challenges faced in adopting risk-safe behavior which are often socially, culturally and contextually embedded. I also discussed theories and models that offer alternative perspectives by opening dialogic opportunities to understand dialectics in the risk perception, behavior,
challenges and future mitigation.

Through this research, I try to address an issue that has traditionally been approached from the dominant paradigm of positivism. Water contamination and environmental public health impacts of contamination have traditionally been perceived and researched from a more natural scientific and biomedical standpoint. Communication of such problems to the affected communities has also happened by using persuasive campaign techniques without any effort to connect with the population. The previous chapter provides both theoretical and empirical evidence that those initiatives have not been fully successful and much still remains to be done. My research consciously seeks an alternative to the dominant approaches to risk communication and mitigation, and adopts a more community-based, critical, cultural and discursive approach to understand the issue. Recent initiatives by several organizations including the Water and Sanitation Program of the World Bank, the Bill and Melinda Gates Foundation, and the National Institute of Health (NIH) and many others are also moving towards more community based initiatives to mitigate contamination induced public health issues. Therefore, I find this an opportune moment to conduct my research.

As Silverman (2010) points out, the methods of research necessarily derives from the theoretical assumptions. I start this chapter with the ontological, epistemological and methodological foundations of different research paradigms, and how my research fits best with the critical theory and constructivism. I state the ontology, epistemology and methodology of my research and rationale for my decision in relation to the background of the topic under study. I provide a history of the site, of the public education and communication initiatives that have been adopted and what worked and what did not. This account is important to situate the
research in both geographic, social, cultural, economic and political context, and to contextualize why it is important to study the topic. After this, I explain the research design which is closely based on the theories, paradigmatic approach, the social-cultural context of the research site, and need to address the issue from a critical social scientific perspective.

**Ontology, Epistemology, Methodology and Paradigms**

For generations, scientific inquiry has been dominated by quantification, and need for generalizability. Mathematics, therefore is often called the queen of science, due to the certainty it provides in terms of quantifiability and generalizability (Guba, 1994). Quantitative scientific research tradition is based on a hypothesis which the research tries to verify or falsify. The results are often binary. Such research approaches have an inherent demand for the inquiry to be objective. However, in social sciences, such demand for quantifiability and objectivity ignore the role of THE researched as a co-researcher.

Lincoln and Guba (1994) provide arguments to critique the dominant paradigm of quantitative research. Their arguments not only critique the metaphysical assumptions of quantitative tradition of inquiry (internal critiques) but also provided justification why alternative and more qualitative inquiry has utility in research. Precise quantitative approaches focus on selected subsets of variables that the researchers may have already perceived. This does not, however, leave enough space for other variables that might exist in the context of the research topic. This *content stripping* might skew the findings of the research if not attended to. Especially, in behavioral sciences and in communication research, all variables cannot be known by the researchers beforehand. Additionally, meanings and purposes of the behavior cannot be separated. Qualitative research, by creating discursive opportunities for the researcher and
researched to share each other’s perspectives, has high potential to provide rich insight into human behavior.

Quantitative traditions in social science focus largely on deriving generalizations and claims to be replicable for the entire population under study. However, this process does not adequately address the individual cases that might have individual differences. Quantitative data is an average, but average might not satisfactorily reflect those who were far from the mean. It typically validates what is already known, in the forms of new hypotheses that have been thought of by the researcher to be tested under different conditions and populations, without leaving enough opportunity for discovering new themes and patterns in the subject under study. Lincoln and Guba (1994, p.108) therefore observe, “Quantitative normative methodology is thus privileged over the insights of creative and divergent thinkers” (italics added).

Qualitative or naturalistic inquiry, termed as the methodological stepchild of the prevailing paradigm in the social and behavioral sciences (Pearce, 1977), tries to equipoise many of the skepticisms of the quantitative traditions. Alternative paradigms to dominant approaches of scientific research have been provided by qualitative inquirers, to capture the inherent interactive nature of the inquirer and inquired that forms a dyad. It is impossible for scientists even in the hard sciences to completely be objective and distant from the facts that they study. Inquirers’ perception of the world is bound to impact what they study, how they study and how they interpret their findings. Lack of absolute certainty has always been social sciences’ hardest obstacle to reach the stature that natural sciences enjoy.

Lincoln and Guba (1994, p 105) discuss four paradigms that exist in social science research, especially qualitative research: positivism, postpositivism, critical theory and related
ideological positions, and constructivism. These paradigms differ in its ontological, epistemological and methodological positions, the fundamental premise on which social science research is conducted. Ontology inquires and seeks to find the nature of truth, and what is there that can be known about the truth. Epistemology inquires and seeks to find the nature of the relationship between the knower or the would-be knower and the potential knowledge. Epistemology is the study of knowledge and justified belief. It is concerned with questions such as necessary and sufficient conditions of knowledge, its sources, its structure, and its limits. Epistemology is about issues having to do with the creation and dissemination of knowledge in particular areas of inquiry (University of Stanford, 2017). Both ontology and epistemology impact the methodological choices the inquirer makes. Lincoln and Guba (1994, p. 109) discuss that ontology, epistemology and methodology of the four paradigms in their classification differ, based on what is believed to be relation between the knower, the knowledge and how knowledge can be gathered and attained.

Positivism refers to the dominant paradigm in which natural and social sciences have traditionally been studied. This not only creates, but also justifies distance between inquirer, inquired and the inquiry to attain and maintain objectivity in research. Ontologically it believes in absolute and apprehendable “truth” that is objective of human existence and interpretation, and is inquired through experimental and manipulative measures. Postpositivist ontology holds that truth is imperfectly apprehendable, due to basically flawed human intellectual mechanisms. To understand true or “real” characteristics of a phenomenon, the phenomenon needs to go through a thorough critical examination. However, even after that, these characteristics cannot be completely apprehendable. Truth is understood through modified objectivism and modified

Traditional risk communication research, and mitigation campaigns, until very recently, largely followed these positivist and post-positivist paradigms, both epistemologically and methodologically.

Recently, both academic and applied researchers have acknowledged the need for more multi-stakeholder approaches in risk communication, and is gradually moving towards alternative paradigms. Critical theory and constructivism shift from the absolute nature of truth and perceives truth as a result of complex historical processes. In Critical Theory, which encompasses several paradigms such as Marxism, feminism, participatory inquiry, truth is shaped by the intersectionality of various historical, social, cultural, political, economic, ethnic and gender factors. Truth is a result of historical processes and is continuously evolving. Epistemologically, critically theory is transactional, and the investigator and investigated (people or object) are interactively linked. The inquirer’s subjectivity, values and positionality invariably affect the process of the inquiry and perception of the truth. Constructivism closely follows the ontology and epistemology of critical theory. Constructivism is based on the ontological principle that there is no absolute truth, truth is socially and culturally constructed in the mind of the inquirer. Epistemologically, both critical theory and constructivist theory are subjective and transactional, wherein inquirer and inquired (both people and topic) are interactively linked, and their relative positions affect the interaction and perception of truth. Therefore, both the process and outcome of the inquiry is value-mediated. This subjectivism and interactional nature essentially necessitates dialectical dialogue between inquirer and inquired to transform ignorance and misapprehensions into more informed consciousness (Guba & Lincoln, 1994, p
The current research required methods that would create discursive space between the researcher and the researched, develop participants’ confidence in the process, to enable them to share thoughts that cannot be shared through surveys. My own prior experience of living and conducting research in the region informed me of potential of such participatory nature of research, both for the research topic and for the population. The traditional, high-context culture of the region has an omnipotent presence in all walks of people’s life. The cultural impact is so powerful that it develops strong mental models which are hard to break. In the context of water contamination, this often leads to fatalism and lack of personal agency in not only risk perception, but also in mitigation. This research is an attempt to break those strongly held mental models or the stereotypes about risk and risk mitigation; through a thorough understanding of how culture, structure and agency contributed in building those mental models, and to enable people to develop new mental models about risk and their personal agency for risk mitigation. Given that, it becomes important to understand the issues within the macro context of the research site and in the personal contexts of the people. All these goals could not have been accomplished by any one method, but required a multiplicity of methods that fitted and complemented and supplemented each other. In consistence with these requirements, I chose three methods that provide excellent combination of a robust methodology. Culture-centered Approach and Mental Models research have been used for resolving chronic social issues in communities. This is often accomplished using a community-based participatory research approach (CBPR). These three methods, when combined, provides opportunities for understanding the chronic issues, mental models of the populations about those issues, and the
contexts in which those mental models came to be, through discursive processes of data collection. While mental models research has predominantly used open-ended interviews, CCA has been done using many different methods, such as critical ethnography, photovoice, content analysis, critical discourse analysis, among many others. For this dissertation, I have used critical ethnography as the method by which I apply the theoretical approaches of CCA and CBPR. Critical ethnographic approach of data collection and analysis shares many similarities with CCA. Critical ethnography follows all the characteristics of ethnographic research, which attempts to elicit participants' meanings and grasp the subject's point of view through qualitative data collection techniques such as interviews, focus groups, observations. However, critical ethnography goes beyond that and links the detailed analysis of ethnographic data to wider social structures and systems of power relationships, an element it essentially shares with CCA. For this research, data was collected through participatory methods such as open-ended interviews and observation of water-fetching behaviors to collect detailed understanding of the lived experiences of people with contamination; data was analyzed using a critical ethnographic approach that attempted to explore and understand dominant discourses and recommend ways to address social power inequities (Ross, Rogers and Duff, 2016); and the analyzed data was organized following a CCA approach that attempted to identify how those social power inequities represented issues of structure, culture and agency. The theoretical and methodological requirements of CBPR ensure that the data collection tools and analysis are overseen by the communities so that they do not reduce to be ‘thick descriptions’ of the populations and their culture, a common criticism of ethnography. At the same time, critical analysis of the themes and categories developed through ethnography and reorganization of those through CCA ensured that
the deeply held mental models are properly attributed to the issues of culture, structure and agency, that is expected to facilitate long-term mitigation by addressing those mental models through right mitigation endeavors. This combination of elements from multiple methods provided prospects for an overall understanding and representation of the issue.

My research aims to create a discursive and dialogic space between the researcher and the researched to understand how risk is dialectically, socially, culturally, and politically constructed in the minds of those who are researched. Thus, paradigmatically, it follows a critical cultural and constructivist approach. This paradigmatic and epistemological background informed and led to the choice of culture-centered approach and community-based participatory research (CBPR) as the theoretical foundations of my research. The Culture-centered approach (CCA) interrogates the communicative processes by which communities are marginalized, the ways this marginalization is perpetuated, and how health risks are constituted, due to uneven distribution of resources both at the material, intellectual and access levels (Dutta, 2007). CBPR provides a collaborative and dialogic approach in research by involving multiple stakeholders in an equitable manner (Minkler & Wallerstein, 2012). Even though mental models research has traditionally been conducted within post-positivist paradigm; for this dissertation, mental models is being used more from a constructivist perspective, as I seek to find how the mental models of risk and mitigation were constructed within the larger structural and cultural systems of the society. CCA and mental models offer ontological foundation for my research, CBPR offers epistemological foundation. While CCA and CBPR are more theoretically grounded within critical-culture and constructivist paradigm, but all three approaches (CCA, CBPR and mental models) methodologically follow the same paradigm, by interactively engaging the inquirer and
the inquired in the meaning making of the subject of the research.

In the next section, I state the site of my research at length. Such contextualizing the site and scene of the problem (Arsenic contamination of groundwater and risk perception by affected people) in a community-based participatory study with CCA and mental models is important as it brings out the social, cultural, political, and economic structure of the site. It is the background and the context of participants’ lived experiences. Knowledge of the background aids to locate the cultural and institutional processes that marginalizes people and creates constraints to practice personal agency; it helps to know how cultural meanings are co-constructed by participants in their interactions with the structures that surround their lives; it informs the cultural, structural and institutional processes that constrain communication and perpetuate unequal power relations in the society. In the context of research, this information is crucial as it helps in making choices about specific data gathering and analysis procedures that breaks the very processes those rendered the marginalized communities’ voices silent, such as ethnography and mental models elicitation techniques, to ensure that the participants’ authentic voices are captured and analyzed within its right context of structure, culture and agency. This ensures that the study genuinely represents the participants’ perceptions.

Site and scene: Arsenic Contamination in West Bengal

Before starting an account of the history of the contamination, it is important to situate the site geographically and socio-culturally. West Bengal is in the Eastern India, bordered by Bay of Bengal in South, and three Indian states in the West. It is the only Indian state which is bordered by three neighboring countries: Nepal and Bhutan in the North and Bangladesh in the East. The following map shows West Bengal’s position in South Asia.
West Bengal is in the western part of Bengal basin and was carved out of Bengal region during India’s independence from British colonizers in 1947. Bengal region and Bengal basin is one of the most populated and impoverished regions in the world. West Bengal is also extremely populated, having the second most population density in India. Traditionally marked by rural agrarian economy, West Bengal is one of the least urbanized states in India. The main livelihoods are agriculture, animal husbandry and pisciculture. The state’s demographic is also
interesting. Though a Hindu majority state, ¼ of West Bengal’s population is Muslim. Muslim population is higher in the rural areas. The Muslim population is increasing due to steady migration from neighboring Bangladesh. The fact that the state was ruled by democratically elected Communist government for 37 years, there have been enough protection and tolerance for minority populations, and co-habitation of all religions was promoted. This geophysical and political structure significantly determine the way water quality issues came to be in the first place, why the risk managers ignored to pay attention to the issue for a long time, and why community perspective has never been sought so as to avoid community confrontation. The socio-political, economic structure also provide the cultural context of why people failed to perceive the risk, and how impoverishment and lack of opportunities for behavior change affected their personal agency to develop Arsenic-safe mitigation behavior. This account of the site and scene will address the intersectionality of structure, culture and agency. In the context of the Bengal region, these three are integrally tied together and affect each other. This intersectionality makes it quite impossible to separate the issues of structure, culture and agency. Therefore, issues of structure, culture and agency will be identified and discussed along the line of the description of historical account.

Water resources and patterns of use in Bengal Basin

Water has always played a significant social, cultural and economic role in Bengal. Bengal basin, politically partitioned between West Bengal, India and Bangladesh, has more than 300 rivers, most of which are tributaries or contributories of the three main rivers of the region, the Ganga-Padma, Brahmaputra and Meghna. India and Bangladesh share these three rivers that contribute significantly to the ecology and economy of both the countries. The Ganges originates in the Himalayan glaciers, flows through India through major industrial cities, and naturally...
bifurcates into two major tributaries, the Hooghly and Padma. Hooghly flows through West Bengal and Padma flows through Bangladesh, both finally separately merging into the Bay of Bengal. Since prehistoric times, the largely rural agrarian people of the Bengal basin have used surface water for drinking, agriculture and irrigation purposes (Majumdar et al. 1978: 30). Due to lack of running water facilities at the household level, surface water is also used for cleaning, washing, bathing, and disposal of human waste and garbage (Subramanian, 2004). Perhaps, the reasonably high availability of surface water in India was one of the reasons there have never been much of conflicts between different religious communities regarding water (Siddiqui 1992: 289). At the same time, this may also explain the considerable lack of attention provided towards water regulation till British colonial era (Siddiqui 1992: 295). Use of surface water has been part of the cultural fabric of the population in the region.

Surface water contamination and use of groundwater

It was not until the second half of the 19th century, the concept of government control over surface waters was introduced by the British colonizers, for trade and traffic purposes (Siddiqui 1992; Cullet & Gupta, 2009). It was also around that time groundwater as an alternative source of water was first explored by the British when water borne diseases were on the rise due to consuming increasingly polluted surface water, resulting in frequent epidemics of cholera, diarrhea and e-coli and deaths of thousands of people. The Geological Survey of India was founded in 1851 to conduct scientific studies to explore the potential of groundwater for drinking purposes (Siddiqui 1992; Limaye, 2012). Since India’s independence in 1947, planners concentrated on development of surface water until several draughts in 1951, 1961, 1962, 1965 and 1972 and frequent outbreak of water-borne diseases made evident the limitations of surface water. (Limaye, 2012). Growing population and industrialization along with human activities had
caused major water pollution in surface water, resulting in an alarming number of people dying of water-borne diseases (Goel, 2006; Cullet & Gupta, 2009). Beginning 1960s, more and more institutional changes were brought in to explore alternate sources of water. Several studies were commissioned by the Government of India, the state governments and several central and state agencies (such as, Geological Survey of India; Exploratory Tubewells Organization; Central Ground Water Board; Central Arid Zone Research Institute; Indian Council of Agriculture Research) to understand the safety of the surface water to be used for drinking (Zahid and Ahmed, 2006). These organizations also started implementing several programs for groundwater exploration and management. Millions of wells were drilled since the 1970s providing access to clean drinking water to millions of people (Gadgil, 1998; Saha, 1995).

*Cultural challenges in acceptance of groundwater*

People initially were apprehensive about using groundwater. Centuries old cultural and religious beliefs prevailed that the underground is where hell is situated and demon/Satan resides there. Therefore, groundwater was also considered demon’s water and evil, with potential to cause more harm than good (Nasreen, 2004). Cultural beliefs also prevailed that since the surface water is always flowing, the pollutants also flow with it and surface water cannot be polluted. The divinity attached with the rivers Ganges/Hooghly/Padma, and Brahmaputra made it even more vulnerable: people believed that these rivers cannot be polluted as they will be self-purified by its divinity. These cultural beliefs impeded people’s personal agency to understand not only the importance of keeping water clean, but also to accept new sources of water. It took a lot of institutional efforts to convince people about groundwater as a viable alternative to increasingly polluted surface water. Even though no official record of any formal communication or
education campaigns can be found, members of the local self-government played a big role in disseminating information, through door-to-door campaigning (Zahid and Ahmed, 2006).

**Gradual acceptance of groundwater and over-exploitation**

One of the factors that led to gradual acceptance of groundwater was that it was easier and more convenient to use, and was clear and better tasting than surface water. In many instances, the tubewells were more proximate than a surface water source. Not only was it quicker to withdraw groundwater, but drilling wells was also found much easier and more economical than trying to clean and purify surface water (Department of Agriculture and Cooperation, Government of India, 2013). Very soon, groundwater was being used to meet all water needs—drinking, cleaning, bathing, irrigation, cattle-rearing, which ultimately led to over-exploitation.

A significant structural issue can be identified with the legal framework of water rights that indirectly facilitated over-exploitation. The Easement Act of 1882, which still exists during the present time, provided every landowner with the right to collect and dispose, within his/her own limits, all water under the land they own and the surface water source that borders their property (Dellapenna, 2001; Getzler 2004). Therefore, it becomes extremely difficult to regulate extraction of ground water as it is owned by the person to whom the land belongs. This institutional process also indirectly places people with smaller amount of land, or landless people in significant disadvantage in terms of access to water. Those who did not have land or had limited ownership, either had to be dependent on the common publicly owned water sources, or had to be dependent on others. In both cases, they were marginalized beyond their choice.

Apart from these institutional processes in perpetuating inequality and power-relations in
access to clean water, there were limitations in the actual communication initiatives that led to acceptance of groundwater as an alternative source of water. While the government efforts to inform the public about safety and usefulness of ground water as a safer choice for drinking was the need of the hour, the actual communication was not well-planned. The communication campaigns did not explicitly mention the limitations with ground water. Ground water has high depreciation value and once it depletes, it cannot be replenished by rainwater as easily as surface water (Central Ground Water Board, Government of India, 2014a; Panda & Wahr, 2016). This gap in communication resulted in people not realizing the hazard of overdrawing ground water. The unplanned mushrooming of wells greatly disturbed the natural habits of the groundwater tables in the already geologically sensitive area (Smith, Lingas, & Rahman, 2000).

*Geological background of As Contamination*

Issues of structure prevailed not only with respect to institutional deficiencies of legal frameworks of water rights, or proper communication, but also with the geological structure of the water tables is the Bengal basin. While Arsenic (As) accumulation in groundwater aquifers in Bengal Basin is largely biogenic, the deficient institutional structure failed to ensure that contamination does not affect the human and non-human population.

It is largely understood by the scientists that the As concentration in the sediments of Bengal Basin is thousands of years old. Problems magnified when As containing particles became dissociated and carried out with sediments during soil erosion, such as flood, tide etc., a frequent phenomenon in coastal West Bengal/Bangladesh. In the post-independent India, rapid growth of industrial activities, urbanization, correspondingly increasing population, and building of several dams on the Ganges, most significant and controversial among them is the Farakka dam, have accelerated sedimentation rates across the course of Ganges, causing more frequent
floods (Karim et al., 1997; Safiuddin & Karim, 2001; Alam et al., 2002; Mirza et al., 2003 Adel, 2001, 2005).

Presently, there are multiple theories about the geochemical and geological mechanisms of As contamination in groundwater. Scientists have found that the layer containing arsenic compound in the sediments of the Bengal Basin is at an average depth between 20 to 80 meters. Due to the excessive extraction of water for irrigation and domestic water supply without inadequate recharge of the aquifer, the groundwater in Bengal has declined progressively in the recent past. This excessive extraction groundwater is believed to be a vital reason for decomposition of the most common ore of arsenic Arsenopyrite, which leads to release and mobilization of arsenic to the subsurface water (The Independent, 1998; (Mandal et al., 1998; Chowdhury, 1999; Nickson et al., 2000; Nickson, McArthur, Ravenscroft, Burgess, & Ahmed, 2000; Chakraborti et al., 2001; Safiuddin & Karim, 2001; Dowling et al., 2002; Lowers et al., 2007; Shamsudduha, Taylor, & Longuevergne, 2012).

Despite absence of a uniform geological theory, all theories indicate overdrawling of groundwater in the last few decades are the main causes (Smith, Lingas, & Rahman, 2000), exacerbated largely by institutional failure to stop rapid, unauthorized drilling of groundwater wells for drinking and irrigation, and failure of governmental agencies to provide clean water through any sustainable sources (India Infrastructure Report, 2011; Goldin, 2016). Consequently, a natural phenomenon such as release of As into water was aggravated by human activities and lack of institutional agency for rectification.

*Exposure to As and its health impacts*

There are primarily three ways people are exposed to As in groundwater: (1) through direct and prolonged consumption of contaminated water, (2) prolonged consumption of food
cultivated/cooked using contaminated water, (3) through direct exposure of bare skin with contaminated water/soil (Mazumder et al, 1998; Smith, Lingas, & Rahman, 2000; Mondal & Polya, 2008; Rahman, Ng & Naidu, 2009). Traditional food habits, such as consumption of rice daily for multiple times has been a major reason for prolonged exposure to As, as rice significantly absorbs As from contaminated irrigation water and soil. Contamination has several chronic health effects such as skin lesions; cancers of lung, bladder, kidney and skin; high blood pressure, high blood sugar, neurological diseases, ophthalmological diseases, gynecological diseases, among others (Das et al, 1996; Mazumder et al, 1998; Mazumder et al, 2000; Rahman et al, 2001; Mahata et al, 2003; Author, 2004; Basu et al, 2004; Mitra et al, 2004; Rahman et al, 2005; Rahman, Ng, & Naidu, 2009; Mondal et al, 2010). Individual cases of contamination may vary in symptoms and intensity, depending on the duration contaminated water has entered one’s body, and other nutritional and lifestyle factors. It very often causes loss of limbs due to chronic infection and untimely death.

Past initiatives of mitigation

Here are more examples of chronic structural and agentic negligence. Institutional failure in As contamination mitigation happened not only in government’s inability to stop mushrooming growth of cheap, unscientific drilling of wells and provide cleaner water, but also the limited attempts of mitigation were neither well-planned not well-executed. Over the past three decades, many initiatives have been taken to mitigate contamination. The following table summarizes the past initiatives of mitigation and why they failed:

<table>
<thead>
<tr>
<th>Mitigation method</th>
<th>Outcome</th>
<th>Communicative issues</th>
<th>Structural issues</th>
<th>Socio-cultural issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household level, such as</td>
<td>- Non-use of filters</td>
<td>- No training and communication</td>
<td>No institution building for (1)</td>
<td>Fear of being punished if the</td>
</tr>
</tbody>
</table>
| SONO filters, 3-Kolshi filters, 2-Kolshi sand filters | • No timely change of filters  
• Unsafe disposal of the filters into ground  
• About the right disposal mechanisms  
• No training on what happens if it is disposed inappropriately | easy purchase of filters, or (2) disposal when filters are deposited with As. | filters go dysfunctional. |
| --- | --- | --- | --- |
| Community-level very shallow or very deep new tubewells & dugwells | • Non-use of filters  
• No community ownership and buy-in  
• Lack of maintenance | Inadequate communication about why new tubewells have been installed, or adverse health effects of using old tubewells | Distance, inaccessibility and inconvenience of fetching water by women |
| Community-level large scale arsenic removal plants | • Non-use of filters  
• No community ownership and buy-in  
• Lack of maintenance | • Inadequate communication about why new tubewells have been installed, or adverse health effects of using old tubewells | Distance, inaccessibility and inconvenience of fetching water by women |
| Marking unsafe tubewells (both household tubewells and community tubewells) | Continued use of unsafe tubewells | Inadequate communication about the adverse health effects of using marked tubewells | No institution building for preventing people from using old tubewells |
| • Taste preferences for certain tubewells.  
• Lack of change in physical qualities in As contaminated water | No institution building for preventing people from using old tubewells |
| Community-level Surface water treatment | Lack of institution building due to high cost | • No community engagement to build awareness | • Distance from surface water source |
| • Visible contamination in surface water leads | • Distance from surface water source |
The past initiatives can be categorized primarily into two types: first type included the initiatives that were implemented at the point of use or household level, such as SONO filters\(^1\), 3-Kolshi filters\(^2\), 2-Kolshi sand filters\(^3\), etc. The second type of initiatives were implemented at the community level, such as installing of large scale arsenic removal plants; promoting use of very shallow or very deep tubewells and dugwells (which have been found to have low arsenic concentration); pond sand filtration; use of surface water treated by filtration and chlorination; and rainwater harvesting (Ahmed \textit{et al.}, 2006; Sharma \textit{et al.}, 2014; Rahman and Al-Muyeed, 2009; Parajuli, 2013). Tubewells have also been tested occasionally to check the As contamination level, and if water is found contaminated, they have either been closed or identification marks have been put on them to identify the ones found to be highly contaminated (Khan \textit{et al.}, 2000, Hassan & Atkins, 2007, Chakraborti \textit{et al.}, 2010).

\(^1\) A composite iron matrix (CIM) adsorbent to remove arsenic and other toxic metals from groundwater in combination with sand, gravel, and charcoal (Hussam, 2009).
\(^2\) A three-pitcher arsenic filtration system containing zero-valent iron as the active component (Munir et al, 2001).
\(^3\) Two buckets (with taps) filled with activated alumina media in series using a stand (Ngai et al, 2007)
In spite of these initiatives, there has been limited success in mitigating the As contamination situation which can be attributed to challenges with structure, culture and agency, of both risk-managing community or the government, scientific community and user community or the villagers, in planning, executing and utilizing the mitigation initiatives (Argos et al., 2010; Flanagan et al, 2012). There are several reasons why there has been limited success in many of these initiatives, many of which have been identified as institutional failure due to lack of considering factors that affect communities’ perception of risk (Chakraborti et al., 2010, Inauen et al., 2013).

Contamination has been continuing despite many government and private efforts, due to a number of socio-cultural and contextual factors (Inauen & Mosler, 2014). This can be attributed to multiple factors: structural incapacity and shortsightedness of government agencies, ignorance of the cultural barriers among users in utilizing/accepting the mitigation efforts, and lack of agency by the government in communicating the health effects of contamination, fear of government of losing people’s support, and low socio-economic demographics and cultural habits of the user community.

Here is one example of a structural-cultural barrier in success of the mitigation plans. Traditionally the staple diet of people in West Bengal/Bangladesh is rice and fish, along with leafy vegetables, lentils and milk. The other main crop of the region is jute. All these crops are extremely water-intensive. Due to the law of inheritance, Land Reform and Ceiling Acts, and lack of cooperative farming, the general size of agricultural land in the region is small. This makes mechanized farming a challenge (Bergmann, 1963; Ghosh, 2010). Paddy and Jute cultivation is done mainly through manual labor that requires them to be in constant touch with
the As contaminated water on a daily basis. Not only does the As contaminated water gets into
the crops through groundwater, irrigation is also done through pumps that draw contaminated
groundwater from the underground wells. Thus, the agricultural practices in the region furthers
exposure to contaminated water (Bhattacharya et al., 2010; Duxbury et al., 2003). No
government effort has been directed into communicating with people about the hazards of this
traditional farming practices nor there have been efforts towards cooperative farming to make it
less labor-intensive. This shows a structural deficiency to mitigate a cultural challenge (cite).

Majority of the past initiatives looked at providing a scientific solution to the problem, by
introducing technology, like different types of filters and filtration systems, both at the household
and community level (Chakraborti et al., 2010). Some of these filtration systems were complex
to use and long-term sustainability issues were not well addressed (Hossain et al., 2005). In case
of household filtration devices, filters needed to be replaced at frequent intervals. There was no
clear instruction on how to change or replace the filters and no institutional infrastructure was
available to make those filters easily available near the point-of-use after the older ones were
defunct. In addition, the users were not communicated how to dispose of the As contaminated
filters (Hossain et al., 2005). This either resulted in disposal of As contaminated filters into open
fields, thus As again getting into the ground, or continued use of the same filters which were not
able to filter any more. In both cases, chances of continued contamination remained high
(Chakraborti et al., 2008). This lack of continued communication and community engagement
further show the shortsightedness of the government agencies in ensuring long-term
sustainability of the mitigation efforts, and structural challenges that communities continued to
face in changing their behavior.
Shortsightedness of government agencies was also evident in the actual mitigation efforts. Almost all efforts centered around filtering As contaminated water for drinking purposes of humans. However, there was no considerable focus given on changing the irrigation practices which still used irrigation tubewells drawing contaminated groundwater, thus making crops, mainly rice, highly contaminated with As. There was also no deliberate attempt to mechanize cropping, which meant farmers had to do everything by hand, seriously exposing them to As every day for a long period of time (Abedin et al., 2002).

The cultural factors were largely ignored in the mitigation efforts, but they were a big reason why many of the mitigation efforts met with limited success. In the deeply religious communities of Bengal, religion plays a major role in the social and cultural life of the people in the region. People believe in Karma or fruit of one’s own deeds. When As contamination initially started showing up in the form of skin lesions, people accepted it as their fate and God’s will. Some also believed that a poisoned well means a snake had been struck while digging of the well and the well is poisoned due to wrath of the snake. Another cultural belief that prevails is that devil, who resides under the ground has been angered by human actions and is punishing people (Paul & De, 2000; Bhuiyan & Uddin 2001). Culturally, wrong is punished very harshly in this region. People fear that if the ‘donated’ devices go wrong, they might be reprimanded, thus they avoid using them. This fear of loss of face and shame is quite intense which makes them further fatalistic. These fatalistic people therefore accept the diseases as fate or as a curse of God for some unknown sin from a past life. This, in the long run, decrease their personal agency of mitigation, information processing behavior and they continue drawing from As contaminated tubewells (Nasreen, 2004).
While the scientists around the world have been making major efforts to find technical solutions to the serious public health problems posed by arsenic in drinking water, communication and public education strategies have received much less attention (Hanchett et al., 2002; Smith et al. 2000). There is significant lack of literature on how the contamination risk was communicated to the public. There is some evidence of public education programs by the local and national governments in Bangladesh. However, no records of systematic communication and public education programs can be found about West Bengal. As a matter of fact, the government in West Bengal repeatedly denied scientists’ claim of Arsenic contamination of groundwater till 1990s, and therefore made very less attempts to communicate or mitigate the risks (Chakraborti et al., 2002). Like most government-led initiatives, the government in West Bengal expected that people would automatically follow government’s initiatives to provide clean water, and therefore made very less attempts to communicate or mitigate the risks. This had serious implications in the mitigation of the issue from multiple perspectives. Late recognition of the issue and secretive attitude of the government regarding the contamination problem kept the affected communities largely unaware of the issues for a long time, seriously compromised their power of mitigation, and caused continued contamination. The largely scientific and biomedical ways of mitigation was completely based on the dominant paradigm of development which was top-down in nature and did not take into account the actual structural, cultural and agentic challenges faced by the community. Therefore, the mitigation initiatives were not truly representative of community needs. The water points were installed at places which were not easily accessible by the user communities, and when they had access, they could not use it well. Due to this lack of community engagement and gap in communication
between risk manager and user communities, the user communities not only lacked voice in planning and executing mitigation, many of the user-communities also lacked actual access to water.

Mitigation actually started through non-governmental initiatives who attempted to break the dominant narrative of top-down mitigation, and tried to educate the communities about the contamination and its ill-effects. A group of doctors and scientists from three government-funded medical colleges and a public research institution took personal initiatives to visit villages with reported Arsenic contamination, and started educating people of the harmful effects of Arsenic in water (Chakraborti et al., 2002). An Arsenic testing lab was set-up in Jadavpur University, a public research institution based in Kolkata, the capital of West Bengal and free water testing facility was provided through the lab. The doctors and researchers also started publishing about the issue in major international academic journals that brought attention of the global scientific community (SOES, n.d.). However, community-based partnership to understand community perception of contamination and mitigation challenges was still absent, thus exposing millions of people to the hazard every day, and marginalizing them further with depreciating health.

Since 1990s, due to increasing attention from global scientific community, the government in West Bengal started recognizing the issue, and commissioned research projects to assess the Arsenic contamination risk in West Bengal. The West Bengal Department of Public Health Engineering (WBPHED), the apex organization responsible for water supply and sanitation in West Bengal undertook a massive water quality survey in 2005-2006 under a joint plan of action with UNICEF to test all the water sources of the districts already identified as affected by multiple national and international reports and surveys (“Critical Areas of Concern in
Water Quality”, WBPHE, 2016).

The mitigation efforts by WBPHED primarily focused on increasing and improving access and availability of clean Arsenic-free water to public through several measures, (1) by installing deep tubewells; (2) by installing Arsenic removal plants; (3) by installing water pipelines in key locations in the villages, such as schools, primary health care centers, village temples; and (4) by marking tubewells with higher Arsenic levels as unsafe. However, these mitigation efforts were not accompanied by any systematic endeavor to inform, educate or communicate people of the risk, and how it affected the communities’ health and wellbeing. The mitigation efforts essentially followed a dominant paradigm of top-down approach, and were based on Rational Choice Theory that government’s efforts of mitigation will necessarily be accepted and followed by the user communities. No efforts were made to address the structural challenges, consider the cultural barriers, or improve the user communities’ personal agency of mitigation. It was assumed that the villagers ‘would not understand’ scientific information due to low educational and socio-economic status, so almost no attempt was made to make the information easy for the villagers to understand (Das et al., 2009). Representatives from WBPHED went to different villages with the local self-government (Panchayat) members to collect samples from the already installed tubewells, both individually owned and communally installed by the government. After testing, if it was found to have Arsenic levels unsafe for human consumption, new and deeper tubewells were installed in few key places in the villages. The locations of those newly installed tubewells were decided by the WBPHED representatives and members of the local self-government, and no attempt was made to align them with the needs of the villagers through any evidence-based need assessment surveys (Hossain et al.,
2005) or any discussions with the villagers. People were neither informed of the results of the water testing, nor were they told whether they needed to stop using their household tubewells. Information dissemination and risk-related communication, if any, came primarily from the member of the local self-government, *Panchayat*. This primarily included local self-government member asking the villagers to start using the newly installed tubewells or Arsenic removal plants for better quality of water, without explaining the risks of not using the new wells or risks associated with using the older wells and risks and impacts of Arsenic contamination on their health. The actual users were never consulted about what mitigation strategies would work the best in the contexts of the respective villages. Tubewells were installed in locations where the WBPHED/ *Panchayat* representatives thought was the most convenient and/or useful, and there was lack of transparency in deciding the location. User communities neither had voice, nor control over those decisions. Instances of corruption, village-level power politics, political favoritism and nepotism were rampant, and perpetuated the power relations between government agencies, bureaucrats and village chiefs. This resulted in lack of understanding and perception of actual risk, community buy-in for the mitigation, and often boycott by some of the villagers of the newly installed wells without really considering repercussions of their decisions on their own health and well-being (Das *et al.*, 2009). This creates a vicious cycle of powerlessness for the user community: they neither have control over the decision on how to access and use natural resources, nor over their own health and wellbeing.

Another structural challenge exists with respect to the official standard of safety level of As. The approved safety level for As in water in India is set at a much higher level (50 μg/litre) than the safety level stipulated by the World Health Organization (10 μg/litre) (Dey *et al.*, 2014).
Thus, even though the water of tubewells is tested and found to be at the margin of the required level for the local standard by WBPHED, many scientists consider that to be much higher than the safety standard, and an inefficient and inappropriate measure (Hussam, 2003).

Structural challenges and limitations exist with respect to the development of alternative water sources, due to high pollution of surface water, higher water salinity near coastal areas, and higher cost in purifying and distributing water through pipelines. This is further complicated by the poor economic conditions and lack of financial capacities of majority of the villagers for supporting village-based water purification systems, household connections of water pipelines or installing of deeper tubewells at the household levels. In areas with chronic poverty and water shortage, water quality takes a backseat and people only concern about actual access to water.

Last but not the least, the nature of the physical risk of As contamination vis-à-vis other types of water contamination pose serious structural, cultural and agentic challenges. Water borne diseases have existed in the region for over centuries due to chronic surface water pollution. Most of these diseases such as cholera, diarrhea, e-coli are caused by fatal bacteria and have immediate and acute effects. Some of these are seasonal and increases during monsoon seasons. Strange it may sound, but water pollution is accepted as part of the culture, and certain household water purification measures are part of the culture in the rural households. There have been countless efforts to promote safer water habits in the region for a long time, many of which started before As contamination issue surfaced. Primarily, two types of measures have been adopted for mitigation: the most common one focused on door to door campaign by primary health workers (a) to raise awareness about potential risks of drinking untreated surface water, (b) to inform them about household based water purifying methods such as boiling and
sedimentation, (c) to distribute water-purifying tablets and ORS in case of outbreak of diarrhea.

Second most common measure adopted to tackle seasonal outbreaks of water-borne diseases was use of a simple microphone placed in a cycle rickshaw with either a live dispatcher or recorded voice informing people of the risks, dos and don’ts. The rickshaw made rounds in village neighborhoods, farmlands and often parked in marketplaces. Due to continued and sustained efforts, these efforts have been able to tackle these water-borne diseases to a satisfactory level (Saha, & Chakrabarti, 1995; Nickson et al., 2000) due to its reach in various demographic sections of the villages. Even though the information in these campaigns were not based on any evidence-based practice of needs assessment, success can be attributed to the fact that the communication materials presented a balance of information about the risks and its potential impacts on human health, with clear directions on easily implementable mitigation strategies. Often these used fear and affect and included specific examples of health impacts on people, including children. The straightforwardness of the risks, potential health impacts and mitigation strategies made it relatively easy for communication efforts to succeed. On the other hand, As contamination does not have any immediate or acute health effects, effects are not consistent for every consumer, and adverse health effects depend strongly on the dose and duration of exposure (Dey et al., 2014). Due to this, there is considerable uncertainty and ambiguity, both among public and medical professionals about how much exposure of Arsenic leads to affect human health, how much time it takes to get affected, what are the organs that can get affected, and how it can be treated (Dr Shyamapada Pati, Personal Communications, August 2016). This poses a significant challenge in developing and disseminating information about Arsenic contamination in the same way other water-borne diseases were communicated. Also, the As compound gets
directly dissolved into the groundwater without changing the organoleptic. This invisible nature of As makes people wonder whether their water is at all contaminated, and therefore they keep consuming the contaminated water (Paul, 2004; Abedin et al., 2002). Additionally, people are used to boiling water to kill harmful bacteria. In many rural and urban households, this is part of a daily routine, and for generations have become a household culture. While this crude method is effective in killing bacteria, it is not effective for purifying As contaminated water. As is a toxic metal, therefore it gets more concentrated after boiling the water, turning it into more toxic. However, such mechanism is hard to explain and no effort has been made to explain it easily to the user community. Boiling water is a simple process, but As purifying process is more complicated, therefore beyond personal agency of rural communities, especially the rural women who are responsible for fetching, cleaning and purifying water.

The prevailing age-old socio-cultural structure mandate community bonding, and trust in the system. On the other hand, the political structure created politically aware, leader-worshipping, political protestors who doubt the system. This dialectics inhibit personal agency. Impoverishment significantly impede personal agency of risk mitigation behaviors, and it has become the cultural fabric of the community. This intersectionality of structure, culture and agency, and how these perpetuate inequality is what would be captured through this research.

**Rationale for non-positivist paradigm and critical ethnographic method**

Complex problems such as this, with deep social, cultural and political roots, need detailed understanding from multi-stakeholder perspectives- the communities who have been facing these issues, and also the risk managers who have been responsible for mitigation. Impacting factors are intertwined and dependent on each other. A detailed understanding of the
context is also important, as is an understanding of the power relations existing between different stakeholders in the different positions of power. Also, it is important that these connections are drawn naturally by those who are being ‘researched’, else it might become overwhelmed by researcher’s own judgment and bias. Participatory approaches of research create discursive spaces so that the communities which have traditionally been rendered voiceless by those in power. It opens up opportunities of communication, which the famous Brazilian educator, Paulo Freire perceived as dialogue and participation for the purpose of creating cultural identity, trust, commitment, ownership and empowerment (Figueroa, Kincaid, Rani, & Lewis, 2002).

Participatory research, by situating and contextualizing the context of the research in the location of the participants, and also conducting actual data collection in that location, helps the researcher understand the participants and their responses better. This spatial and temporal situating of research facilitates the researcher to understand the intersectionalities of the impacting factors that cause increasing marginalization of the communities. It further helps in reconciliation of the researchers’ and participants’ knowledge and understanding of the issues. Participatory methods, by creating dialogic and collaborative space between the researcher and researched empower both. The discursive space thus created helps to ease the dialectics between researcher and researched, and also between the stakeholders. In these paradigms, the research is not an end in itself, but a means to an end, the end being empowerment of both. Such an approach helps in open sharing of lived experiences of the research participants, and co-creating of meaning.

**Researcher’s Positionality**

In both CCA and CBPR approaches, it is commonly recognized that neither the
theoretical nor the methodological decisions can be completely detached from the researcher. When a researcher implements a particular method, he/she is constantly building upon his/her own ideas about how the world works, what people are like, and so on. Methods are inherently tied with theory and researcher’s own understanding of that theory. The choice of how a given topic will be investigated will also depend on the very nature of the topic itself and the researcher’s relationship with that subject. More often researcher’s personal ontological and epistemological positions are not openly spelt out, but are rather implicit in the theoretical approaches they choose and the methodologies they adopt. Ontological and epistemological positions are pivotal to a research, as it defines and shapes the choices a researcher makes in the course of the research. Ontology and epistemologies are deeply grounded on the researcher’s beliefs about the world, and the way those beliefs came into being. By influencing researcher’s scholarly choices, they impact the way researcher sees the world (Silverman & Marvasti, 2008).

Finding one’s own positionality as a researcher is an important part of embarking on a research project. Even though a researcher’s positionality may change over the course of the research, with the rising experiences into the various stages of the research informing new ideas and knowledge, but the research should start with an underlying ontology and epistemology which should remain the same.

Research is a process, not just a product (England, 1994). In this process, both researcher and the participants are instruments of the research, and their relative position in understanding the meaning, value and implications impact the process itself and research outcome. Research represents a shared space, therefore both researcher’s and participants’ identities and personalities will impact the research. It is therefore important to discuss my positionality as a
researcher in the research process, especially since in CCA and CBPR approaches, researcher and participants closely share the research space. The researcher’s positionality reflects the social, cultural, experiential factors that impact the decision, process and outcome of the research. Silverman (2016) asserts that this form an integral part of research methodology. My positionality affected my choice of the subject of the research, choice of the method, and decisions throughout the course of the research.

Positionality in choosing the topic:

The underlying decision to conduct this research stemmed from my own experience of growing up in the same geographical area where the research was conducted, and knowledge of the intensity and gravity of the contamination. Even though I grew up in urban areas where the contamination has not affected due to advanced water purifying system paid through higher property tax, I had seen the repercussions of water contamination in the people living in more rural/suburban areas during my travels to rural areas. As someone belonging to the same culture, I identified how the issue was exacerbated by the political structure, and embedded in the socio-cultural structure of the region. A sense of place works in the psyche of the people in the region that ties them to the place they live in, and that is the reason why they accept everything as something given to them by God and the place itself. This sense of place and the cultural embeddedness makes this issue a deeply cultural and social one at the mitigation level. It was a conscious decision to work on this study as I wanted to give back to the community that has nurtured me, and bring about some positive social change to the place I belong. Even though my specific cultural and spatial experience was different from my participants, I had higher familiarity and relative advantages of not drawing ‘thick descriptions’ of culture and behavioral
patterns of the population I studied. For example, it was easier for me to understand why a Hindu woman had to wake up early and bathe before entering the kitchen as it was a mandated cultural practice not commonly known to outsiders; or why a woman could not replace her ailing husband and took care of the family business as it was a taboo for a woman to enter into a domain largely reserved for men; or why daughters are married off young in the absence of male members in the family due to the deeply patriarchal structure of the society.

Positionality in choosing the method:

Having been born and brought up in a traditional collectivist culture where community and people are given supreme importance over individual selves shaped my ‘research personality’. As a child, I was taught to learn from the environment- from the trees, water, air, and from people. This process of learning from the environment always kept me grounded, realistic, pragmatic and a hands-on worker. Throughout childhood I was told to concentrate on the process of learning and not the outcomes. The process itself defines learning. This process-oriented learning had very strong influence on my research ideologies and life philosophy as whole. As a researcher, I am interested in methodological research. The theoretical and methodological position of CBPR, and CCA provide opportunities for methodological research and process-based learning throughout the research process. They define and validate my core research personality. For example, CBPR requires the researcher to be a part of the research process, not only as a researcher, but also as a partner. Likewise, in CCA, the meaning-making of communities’ lived experiences also have to be mutually understood, not only as a researcher, but also as a participant. Despite being from outside the community, this dual position of the researcher-participant needed constant rapport building, and discussion of issues not limited to
just the research questions. To build confidence in my participants, I frequently engaged in informal conversations about their life in general. These discussions were as rich as the ‘actual’ data collection, as the participants shared their stories which otherwise would not have been captured just through the interview questions. This process of rapport building and informal discussions helped me parse out the intersectional connections between structure, culture and agency in communities’ risk perception and mitigation behaviors.

Positionality throughout the research process:

The fact that I am part of the culture of my research participants, share their physical features, speak the same language, follow the similar gastronomic traditions, and have understanding of the issue through empirical experiences immensely helped me in placing the issue in the right context, and also in ethnographic data collection. I could place myself within the same cultural frame of the target population and thus could establish myself as an insider of the community, which often marks success of the ethnographic/qualitative studies. At the same time, other than the broad cultural similarities, my experience of living in the region was markedly different from my participants. Therefore, throughout the research process, I was uniquely positioned both as an in-group member and out-group member. Due to similar ethnic appearance and ability to speak the local language, I did not need a translator. This helped me get better access to the community members. However, at every point, I was also contested and asked about my own experience with water contamination. I had limited personal exposure to water contamination. I was also asked about my personal capacity to bring about changes to the system. This placed me as an out-group member. I was still perceived as an outside researcher, like many others before me, who had gone and spoken to the communities before without being
able to bring change. While I was appreciated for wanting to do something for the communities, I was continuously met with doubtful apprehensions.

There were other micro level disconnects with the population, which are important in the context of the culture and population of the research location. A large part of the target population were followers of Islam, and the Hindu population belonged to lower castes. Literacy rate is relatively lower than the national average, even lower among women. Also, female members of the community mostly stayed at home, and only engaged in farming. In this context, my identity was in contrast with majority of my participants. My identity was often perceived as an urban, educated upper caste, upper class female which often created a power distance between me and my research participants. At this point, my research training on qualitative research methods helped me counter these challenges. I always mentioned that they are the experts when it comes to their own experiences and I have limited knowledge about that.

My positionality reaffirmed the need for the research to be based on critical-cultural, and constructivist paradigm. The research not only needed to be community-based, but also community-driven. To gain the trust of the community members, I spent long time with them talking about issues that concerned them, much beyond my core research topic of water contamination. These interactions had two positive implications: this helped me gain their trust as an individual interested in knowing them, beyond the limited scope of my role as the researcher. This also helped them (and me) perceive the intersectionality between different issues the communities were facing, and how their personal actions have brought about change, or had the potential to do so.

Being mindful to the fact that these communities have already been researched multiple
times by different stakeholders, my research focused on ‘knowledge gathering’ rather than ‘data collection’. As a researcher in communication for social change, I have a strong understanding that right information in the right context to the right people is what is lacking in most of the development communication initiatives. Through my research, I wanted to provide a discursive space to the communities to speak to someone who wanted to listen to what they had to say in an open and non-judgmental manner, not just what the researcher wanted to hear. Given the varying degrees of socio-cultural and economic conditions of most my research participants, interpersonal communication is often the most effective tool of ‘knowing the respondents’ in a ‘well-rounded’ manner.

For long time, the communities that my research participants belonged to, have either been neglected, or have been used as political vote bank by political parties. In the last three decades, they have also been topic of innumerable scientific research and have been researchers’ Guinea pigs to implement new technology, without ever consulting the communities of their needs. My positionality as a social scientist gave me better access to the communities. They were initially surprised by not finding me with a stethoscope, as they were most frequently visited by doctors, or finding me able to speak Bengali. They frequently asked me what I want to know, in answer to which I asked them to share everything they associate with water quality. This helped them and myself elicit their inner mental constructs of water quality issues, along with far-fetched consequences of contamination.

Both class and gender play crucial roles in who is affected more by the contamination. It has been found time and again that women are more vulnerable to any environmental changes, since they live closer to the environment and interact with environment more than their male
counters. In case of the location of my research, women have more direct contact with contaminated water than men, due to their water-drawing responsibilities, and as crucial workforce in the production of two of the most important crops in the region, paddy and jute, both of which are labor intensive and water-intensive crops. Due to cultural practices, women also neglect their health to favor their children and male counterparts. So even when they have limited access to purified water, it is usually set aside for children, elderlies and male members before women use it. Due to cultural beliefs tied to women’s roles in household matters, their chances of getting affected by contamination is more serious in all ages. At the same time, women are the most inaccessible and neglected ones in both research, and information dissemination. Most of the previous researchers have been men, and in only limited instances female-foreigner who could not speak the local language. This limited women’s chances of open sharing of their perception on the issue. My research wanted to address that lacuna. My position as a Bengali-speaking woman facilitated greater access to woman, and woman spoke to me more openly about issues that they could not speak to the researchers before me. My ideological, socio-cultural, and demographic positionality, and methodological expertise and background not only impacted my choices before and during the research, but also facilitated the ethnographic research design and data collection.

**Research Design**

The research was based on Cummins and colleagues’ (2011) creative designs of engaging the community in a collaborative manner, taking into consideration:

“(a) the community's extensive knowledge of the local environment, environmental degradation and potentially related human health issues; (b) the community's traditional respect
for and relationship to the land and water; (c) the community's need for data to answer local questions; (d) Western scientific knowledge of environmental health and of risk assessment methodology; (e) what research is valuable to other rural or minority communities” (Cummins et al., 2011).

At all stages, research design was driven by the ontological, epistemological and methodological principles of critical-cultural and constructivist paradigm, as outlined in community-based participatory research (CBPR), mental models and culture-centered approach (CCA). This research was based on the postulation that risk perception is a socially constructed phenomenon, and is a consequence of inequalities that can be attributed to power and subjugations created from (mis)use of that power. The effects of this domination and inequality is pervasive and tend to affect every walk of life, and create deeper mental constructs that needs deeper understanding. Therefore, it is crucial that these meanings and consequences of the domination and inequality are understood through interacting and exploring the perspectives of the people who suffer due to that domination and inequality. Critical-cultural and constructivist paradigm rely on an epistemology of experiential and participative knowing (Reason, 1998. pp.261–291), informed by critical subjectivity and participatory transaction (Lincoln & Guba, 2000. pp.163–188). Following this epistemology, CBPR, CCA and mental models focus on collaborative and bottom-up approach, in identifying and defining problems, and developing and implementing solutions (i.e., research “with” rather than “for” or “on”) (Oetzel, Pant, and Rao, 2016). To that end, the current research was developed in collaboration with the community members, conducted in the context and location of the community, with open-ended questionnaires that provided space for participative knowing of both community participants and
the researchers, to fully comprehend the perspectives of people on how their risk perception was socially constructed and risk behavior was impeded as an interplay of structure, culture and agency.

However, a robust community-based study requires the researcher to be based in the community for a long time. Being an academically oriented research leading to a dissertation, there were some challenges with limited time and resources. Therefore, the research was developed as a formative and pilot study to inform the researcher how a more robust community-based action-oriented research can be developed in the future.

The research fully incorporated the theoretical principles of participatory research. I initially started working on the topic in 2014. I had gotten in touch with several academic researchers and scientists who had been working on this issue in both India and Bangladesh. These researchers were both local researchers; local researchers from India and Bangladesh who had been working in foreign universities; and foreign researchers who worked on the issue in the region. This background research, coupled with my own personal experience of living in the area during her formative years gave me multidimensional perspectives of both an insider and outsider, from both positivist and critical-cultural perspectives. The research design was continuously informed and influenced by those often contrasting but rich perspectives.

The decision to turn this topical interest into a dissertation project came while speaking to a locally based scientist (based in Kolkata, the capital city of West Bengal) who had been working on the issue for at least three decades. An environmental chemist by training, the scientist had visited thousands of villages in India and Bangladesh, and had realized that existing persuasive campaigns fail to create awareness of the issue. He urged me to do a sociological and
ethnographic study, to reach out to the communities directly.

The background research involved reading academic papers in both natural and social sciences; field research reports prepared by scientists, and risk management organizations including government agencies; and personal solicitation with several researchers who had studied the issue. Background research highlighted serious lack of social scientific studies and community voice in the mitigation efforts. There was almost complete lack of research or implementation studies based on non-positivist paradigms which reaffirmed the need for a study based on critical paradigm. This led to the decision of a community-based participatory study to understand community perspectives, and listen to the community’s voice.

Due to limited precedence of community-based studies on the topic in the region, initial study instruments were developed by me with advice from my academic advising committee; based on the literature available with similar issue and similar population in the global context. During this time, I constantly kept touch with the local researchers who had worked on the issue and had more ‘first-hand’ experience of working in the intersection of the issue in the research site. On reaching the research location, I actively engaged with both the experts and community members to contextualize the study instruments, to locate the at-risk villages, and to identify potential participants. Two pilot interviews were conducted with an expert and a community member to verify the cultural and contextual relevance of the study instruments, and edits were made accordingly. A participatory field-study was conducted in 14 villages in 4 blocks in the North 24 Paraganas district of West Bengal, India in the months of June, July August 2016. WSU Institutional Review Board approved the study.

Community partnership building

All the village communities were approached through a local university and community-
based civil society organization (CSO) working in the community for more than two decades. The CSO was run and managed by some scientists, doctors and villagers, and enjoyed considerable rapport and trust within the community and the local bureaucrats (such as police, local self-government known as Panchayat and district head called collector/magistrate). The CSO was apolitical and non-religious, and generated funds primarily through donations from non-political sources, and personal donations. They arrange medical camps for Arsenic affected patients, distribute medicines, provide transportation for taking patients to district/city hospitals for treatments, and sometimes provide monetary help to patients’/deceased’s families. Due to working for many years in the communities, the CSO was aware of the community’s social, cultural, historical and structural contexts well, had a strong social network in the villages, and also had personal access to the community members and village opinion leaders, such as teachers, religious leaders. This CSO was crucial in both connecting me with the community members and village-based risk managers, and facilitating data collection.

The local university partner, the School of Environmental Studies of Jadavpur University has been working on Arsenic contamination in Bengal basin for close to thirty-five years. The researchers working there are aware of the scientific origin of the problem well, and have recently started recognizing the need for connecting with the affected communities with social scientific methods to better mitigate the risk. The university facilitated access to experts, such as doctors, scientists and a non-governmental organization. The vice-chancellor of the University was appraised of this study, and approved the study.

**Participant Selection and recruitment**

Participants included experts such as scientists who has been working in/on the area; risk managers such as bureaucrats and water companies; local health providers such as doctors,
health practitioners, primary public health workers, quakes; religious leaders such as priests, astrologers, etc; and different segments of the community members. Community participants included those who either already have Arsenic-related diseases, or are susceptible to contamination due to (1) location, (2) occupation, (3) continued exposure; and those who are target audience of mitigation efforts based on (4) age, (5) gender, (6) social roles and leadership. Prior risk perception studies point at variability of risk perception among different sections of the same community due to age, gender, educational status, (Griffin and Dunwoody, 2000). In line with that, potential community participants included (1) young male and female (in reproductive age and in households with young children); (2) older male and female (not in reproductive age, in household with young independent adults), (3) young adults (male and female, in college-going age, unmarried and preferably in college). While the older and younger generation are more vulnerable to As contamination due to age, young adults with older parents and children at the household are more susceptible to contamination due to their greater exposure to As contamination due to water habits (such as cleaning) and occupation (such as farming). Not all participants were currently affected by Arsenic related diseases, but had high potential of getting affected due to their water use habits and occupations. Community members with occupations such as non-mechanized farming, animal husbandry, fish-farming or other water-intensive farm practices were selected. Community members had to be living in an As contaminated village for at least five years to be included as participants.

The community members were recruited in consultation with the local community-based organization and the university partner, mainly through word of mouth and announcements in village panchayat (local self-government consisting of elected members from the village)
meetings, in the meetings at the places of worship, in primary health care centers, and/or door to door call for participation. Use of local media, such as village-based cable networks were initially planned, but was not feasible and therefore not used for recruiting participants. Due to low literacy, low access to electricity and lack of access to media sources, use of media was mostly irrelevant. Certain religious beliefs and practices also restricted access to electronic media. For example, during the participant recruitment stage it was found that in several Muslim majority villages, any kind of Western-influenced media (such as radio, television) were considered anti-religious, and therefore was prohibited by the local religious chief of the community. The community members’ social networks, such as extended family and friends were the most crucial and useful strategy in recruitment of participants.

For this study, door-to-door recruitment method was primarily adopted, with the help of village opinion leaders such as local panchayat member, primary health workers, teachers of local schools, and the post-master of the local post-office. The most important community link was a community-based social worker recruited by the local university who resided in one of the Arsenic-affected villages, and was a patient himself who developed crucial connections with the communities by directly working on the issue for more than two decades. He constantly shared his and others’ stories, to inspire change. Involvement of a community social worker facilitated access to the villages and ensured that the researcher was not considered a stranger—two crucial requirements in a community-based participatory research.

**Sampling**

Participants were recruited through a variety of sampling methods. Given the fact that the participants had to be recruited through a CBO partner, a representative sampling was hard to achieve. Instead, it was attempted to achieve a fixed number of interviewees and to include a
maximum variety in populations. Prior researches document the need for a large number of participants, to be able to include different voices from a community. For example, in a CBPR study on housing quality and health among migrant farmworkers in North Carolina, 30 participants were interviewed to reach data saturation (Keim-Malpass et al., 2015). In another study on risk perception of PCBs with former workers who were exposed to the chemical earlier in their lives, data saturation was reached after interviewing 29 participants (Fujishiro et al., 2013). In another qualitative case study on relationships between public health and municipal drinking water and wastewater in Coral Harbour, Nunavut in Canada, researchers found data saturation after 37 interviews (Daley et al., 2014).

For this research, due to the magnitude of the risk in a big geographical area, prevalence of the issue for close to four decades, and demographic heterogeneity of the population, a larger number of participants was desirable to reach saturation. Therefore, initially it was planned to recruit 30 males and 30 females from various age groups. More participants were to be recruited if data saturation was not reached by this sample. Ultimately, by the end of the study, a total of 80 community participants participated in the study, out of which 51% were males and 49% were females between the age of 21 years to 82 years. This increased number of participants can be accounted to the collectivist culture of the research location. For example, when one community member was being interviewed, people from the neighboring houses also came in. Those people often offered to express their opinion. In the villages, it would have been perceived rude to not include those volunteer participants, and also would have gone against the principles of participatory research. Therefore, more people had to be added on as the research progressed.

Initial recruitment was done through a combination of convenience sampling, judgment
sampling, and snowball sampling. First, 20 participants were recruited through convenience sampling, in which the most easily accessible population was selected (Anderson, 2001), and judgment sampling, in which most productive sample was actively sought (Marshall, 1996). In the initial phase, a recruitment framework was developed of variables that might influence a participants’ answer, based on the practical knowledge of the research area, and available literature and evidences from the secondary research of background of the research site. This was then shared with the community partner and university partner, to mutually identify the groups of people through a combination of demographic and situational factors (Marshall, 1996). Each participant was paid a nominal honorarium of INR 100 (approximately $1.5) as a remuneration for participation.

Subsequent participants were recruited through theoretical sampling. Theoretical sampling necessitates building interpretative theories from the emerging data and selecting a new sample to examine and elaborate on the emerged theory. To connect to those demographic and social groups who emerged as theoretically important for the study in the first phase, subsequent participants were identified. In the villages, interpersonal networks are an effective medium to communicate. Therefore, using community members’ own personal network helped to identify some of the potential participants. One potential problem that might have arisen is, due to the monetary incentive, there might have been favoritism among the community members to identify potential future participants. This was hard to eliminate. However, care was taken to interview only those (individuals or families) who either have exposure to Arsenic contamination, or have high potential of being contaminated in future. Time for the interview varied, and depended on the interviewees’ personal experience with contamination, and willingness to share their stories.
For example, one interviewee burst into cry after only 30 mins while sharing the story of her husband’s death due induced by contamination; while another shared her own story of personal loss for more than an hour, and suggested changes in policy. On average, interviews lasted between minimum 35 minutes to maximum 1 hour 45 minutes and were audio recorded.

In addition, twenty-two experts and risk managers who currently work or have worked in the Arsenic contaminated villages in West Bengal, such as scientists, doctors, primary health care workers, bureaucrats, school/college teachers of local schools/colleges, and representatives from the local self-governments and non-governmental organizations were also interviewed. Representatives of the local self-governments of each village where community members were interviewed, were contacted for interview. Local self-governments are political units, and the representatives are democratically elected members accountable to both public and political scrutiny. Some of the representatives declined to be interviewed. Scientists and doctors were all city-based at the time of the interviews. Doctors were all either currently employed or retired from the government managed hospitals. They had visited the villages both as government doctors or on independent capacity in collaboration with the local CSO. They had experience organizing medical camps and referring the patients to city hospitals. Teachers and principals from four elementary schools were interviewed. The schools were all government sponsored/managed schools, and catered to low income communities. Three professors were interviewed from one local government undergraduate college. This college was the venue for an international conference in 2014 on community resilience building for Arsenic contamination. The college also ran civic engagement projects with students aiming at awareness generation for contamination mitigation. Interviews with the experts lasted minimum 50 minutes to maximum 2
hours and were audio recorded.

Apart from the interviews, two focus groups were also conducted. One focus group was attended by twenty-two village-based primary health workers, known as Auxiliary Nurse Midwife (ANM), and Accredited Social Health Activist (ASHA). ASHA are women resident of the village who is married/widowed/divorced, between 25 to 45 years, and are qualified minimum up to 10th grade. They are primarily responsible for door-to-door service for community health, promoting universal immunization, referral and escort services for Reproductive & Child Health (RCH), family planning and other essential family healthcare programs, and construction of household toilets. Selected from the village itself and accountable to it, ASHA are trained to work as an interface between the community and the public health system and the first point of contact of the villagers for any health-related queries and concerns. ANMs are supervisors to ASHA, are minimum 10th grade passed with a post-secondary nursing diploma, work at health sub-centers and responsible for maternal and child health along with family planning services, health and nutrition education, efforts for maintaining environmental sanitation, actual immunization procedures for control of communicable diseases, treatment of minor injuries, and first aid in emergencies and disasters. Focus group was conducted during the monthly reporting meeting between ANMs and ASHAs. The focus group was especially organized for the purpose of the research and was moderated by the researcher. The focus group lasted for 2 hours and fifteen minutes, and was audio recorded.

Another focus group was conducted with eight students of the local government college. The students were all undergraduate students in their 2nd or 3rd year of college (sophomores and juniors), lived within 5 kms radius of the college, and were studying either Education or Rural
Development. None of them had attended the conference in 2014 or any of the civic engagement programs. The focus group lasted for 1 hour 30 minutes and was audio recorded. Thus, in total, one hundred and thirty-two people were interviewed as part of this study.

Data collection

Overall data collection involved multiple activities, such as:

1. Archival research of various government documents: To identify historical and geopolitical issues in Arsenic contamination in the region, local water treatment plans, mitigation interventions, and public education campaigns.

2. In-depth interviews with experts, risk managers, opinion leaders: To understand current policy and programs on risk mitigation; public education and communication; experts’ opinion on community’s knowledge and perception of risk, attitudes towards perceived risk, and barriers to safe risk mitigation behavior; and political and economic barriers to change.

3. In-depth interviews with different segments of community members in potentially at-risk villages: To understand the intersectionality in historical, social, cultural, political, economic and contextual factors in community’s knowledge and perception of risk, attitudes towards perceived risk, and barriers to safe risk mitigation behavior.

The study instruments could not follow some of the principles of community-based collaborative research, such as vetting and approving of the instruments by the community members, and pilot interviews to validate the instruments. At the same time, to mitigate researchers’ bias, the study instruments, both for the villagers and experts were duly checked by several people- the researchers in the local university partner and their field staff (mostly community members working for the university), and piloted with a group of community member from the proposed sample, to make modifications before actual data collection began.
Also, the interviews were conducted in the villages, at a convenient time and place chosen by the community member and agreed upon by the researcher.

Data collection with both community members and experts were done using in-depth ethnographic interviews with open-ended questions. The study instruments followed the structure of mental models interviews articulated by Morgan and colleagues (Morgan et al., 2002), such as use of open-ended questions, conducting experts’ interviews both before and during data collection with the community members. However, experts’ interviews were conducted to understand experts’ understanding of the issue and their perspective of the community, and to understand both experts’ and community members’ perspectives in relation to each other, and not to inform the questionnaire or data collection with the communities, which is usually the purpose of experts’ interviews in mental models studies. The use of the structure of mental models interview was to facilitate elicitation of deepest mental models and the stakeholders associated those in the various contexts of the issue.

All interviews with the villagers, representatives of the local self-governments, and the focus group with the public health workers were conducted solely in Bengali, the native language of West Bengal. Interviews with the community opinion leaders, teachers in the schools and the colleges, and the focus group with the college students were conducted in a mix of Bengali and English. Interviews with the scientists and doctors were conducted in English. The research protocol for the villagers were developed in Bengali, whereas the research protocol with the experts were developed both in Bengali and English, and the linguistic medium of interaction was decided on-field. Interviews with the villagers followed an in-depth ethnographic interview structure with open-ended questions. The interviews were flexible, and allowed the
respondents full freedom and comfort to share their story about the focal issue. The primary task of the interviewer was to facilitate the villagers to organize ideas in the direction of the focal issue. This allowed the respondents to steer the interview process and allow them to share all connected perspectives, understanding and knowledge about water quality, the contamination, their lived experiences with it, and how it has impacted their life as a whole in addition to the health impacts. Interviewees were allowed to share their story without being restricted to strictly follow the protocol, only occasionally prompted by the interviewer to remain within the focal issue and to not lose the context altogether. Apart from the interviews and the focus groups, researcher also visited multiple community water points, both As contaminated shallow wells and safe-marked deep wells, water purification systems, and observed the community dynamics during drawing of water.

Data analysis

One of the characteristics of critical ethnography is simultaneous processing of data, to find themes and categories can be fed into subsequent data collection (Thomas, 1993). I started analyzing the data by reading of the field notes taken during the interviews. This was done every night for the interviews collected on that day. This helped me keep abreast with the trends that was emerging through the data, and helped me understand the subsequent responses in the right perspective. However, transcripts were not done at this stage. At this level, analysis of the notes was primarily done using thematic analysis methods and followed the themes pre-identified in the formative research and outlined in the research questions, but remained open to other trends that emerged throughout the course of data collection. This ensured that the study is continuously modified and customized to adequately reflect the emerging needs to incorporate new samples and questions (Mills et al., 2006). More in-depth, rigorous and critical data analysis that followed
data analysis techniques stipulated in critical ethnography was done after the conclusion of the field research which is explained later in this section.

I printed the interview questionnaire for each participant, and made extensive field notes in the study instrument during the interview. Each individual interview data was also audio-recorded, transcribed and translated. Field notes not only included the basic demographic details and location, but also the responses, cultural cues, non-verbal body language, interpersonal interactions of the respondents with the other members of the community who had gathered around during the interviews, and other significant cultural/contextual factors pertaining to the respondents, his/her family and the village which could otherwise not be captured by the interview protocol or audio recorded data. I also often made note of special quotes that the respondents might have made during the interviews. Field notes are considered important documentation in ethnographic field research, and add personalization to the collected data (Mulhall, 2003; (Oladele, Richter, Clark and Laing, 2012).

To mitigate researcher’s bias, transcription and translation into English was done by an external transcriber fluent with both Bengali and English, familiar with the research location, and trained on qualitative research analysis techniques. The transcriber was a recent MA in Human Geography from University of Calcutta, West Bengal, and was preparing for her PhD. The external transcriber was duly trained by me on the context of the research and context of the participants, along with transcription methods. The external transcriber was remunerated for the task. The transcriber did not visit any of the research locations (the villages) during or after the research was conducted. I did not share my field notes with the transcriber.

All transcriptions were done using Microsoft Excel. The first column identified the
speaker (interviewer or interviewee), the second column captured what was being said, and the third column captured any audible and comprehensible human chatter from the surrounding. As mentioned before, in the collectivist culture of the research location, usually a lot of people from the neighboring houses came in during the interviews, and shared their perspectives. Though some of those people were interviewed, not all of them were interviewed. It was found important to capture those side chatters as those represented people’s initial reactions and natural opinions about the issue without even being explicitly asked to share their opinions. This also added to the richness of the collected data and the research. In-depth interviews were not conducted with all of them, or conducted on another day, to avoid intentional or unintentional repetition, bias, conformity or refutation that could occur from listening to the responses of the first respondent.

After the transcriber transcribed all the audio-recordings, I listened to the recordings again, and checked the transcripts. At this point, I made slight changes in the transcript wherever needed, and cross checked the transcripts with my field notes.

As mentioned before, I started analyzing data from day one of data collection, from the field notes, every night for that day’s interviews. It helped me to remain abreast with the trend in the responses which were then fed into subsequent interviews. Data analysis took place in multiple stages. At the outset, thematic analysis of the textual responses was done to find the trends in the responses. Subcodes, codes and themes were developed in the initial data analysis process. Following Saldana’s coding manual (Saldana, 2003), coding process involved two cycles: in the first cycle, the unit of the coding was single sentences, small phrases. These codes were developed after thoroughly reading each respondent’s interview transcript. These data were then cross-checked between respondents, then were conjugated with each other to find trends in
the responses. At this point it was observed if there was any particular trend that was emerging in
the types of responses given by the respondents. The recurring codes were developed into themes
to categorize them into broad headings. The codes emerging from first cycle of coding were
summarized, compressed or condensed into themes in the second cycle of coding. Every stage of
data analysis, non-recurring codes were separately noted as outliers for further analysis, and
some of those were developed into case studies.

Chronologically, in each cycle, coding was done in two stages. One code might come up
while reading a transcript for the first time, but as the researcher went through the whole
transcript, it might have been required to relook at some of the sections which required a
different code. It was kept in mind that the codes made sense in the overall context of the
responses given and not only in the context of a sentence or the paragraph, or of one respondent,
but also in the context of the location and other situational factors the respondent was situated in.

Even though the initial data collection followed a thematic analysis, purpose of the
analysis was not just to find themes and subthemes. Each interview data was carefully and
critically analyzed and the themes were not an average of what they said, but an aggregate of all
the perspectives of the interviewees. Analysis did not just seek answers to the research questions,
but also critically looked for issues that the respondents themselves identified which might or
might not have been asked to them. The purpose was to find the inner mental constructs that the
respondents associate with the issue of water quality and contamination, both as cause and
consequence of the contamination, and why and how they mitigate or cannot mitigate the risk.
Therefore, the themes and codes developed in the initial data analysis provided a foundation for
organizing the critical analysis done subsequently.
The critical analysis of data closely followed the overall themes of Culture-Centered Approach (CCA). As outlined in the previous chapter, the underlying goals of culture-centered approach is to understand:

(a) the location of communication within the complex interplay of structure and culture,
(b) the ways in which individual and collective agencies are enacted within and in resistance to structural constraints, and (c) the interactions of human agency and communicative processes in bringing about social change and structural transformation (Dutta, 2007).

The critical analysis involved analyzing the interview transcripts word-by-word, and sentence-by-sentence analysis of the text of the interview transcript to see how the interviewees' verbal texts and non-verbal cues represent an issue as that of structure, culture, or as an issue with personal or collective agency, or a complex interplay of those. This was done at every stage of analysis and every unit. At the level of individual respondent’s transcript analysis, responses were analyzed in the light of the background information of the respondents. At the level of the codes and themes, this micro-level context could not be adequately captured. At this level, codes and themes were analyzed in the context of the research location, the social, cultural, political and economic status, gender, and how these contexts interplayed with structure, culture and agency.

Data analysis involved a balancing act, even though the planning for such analysis was seeded in the actual data collection processes itself. I, as a researcher, wanted to provide the opportunity of critical reflection of the issue to the participants. Such data collection conforms to the principle of participatory research, where the research process itself empowers the participants and they make crucial connections between the causes and consequences of their
subjugated positions. They were not just the respondents of a research study, but they were participants in the process of knowledge acquisition from the research through collaborative and participative knowing. This way, not only me as a researcher, but the participants also perceived how the social, political, and cultural structures perpetuate their subjugated positions, and critically reflected on how they can bring about some change in their own lives through the means that they already have, without making major structural changes in the water infrastructure.

This research process which borrowed principles from CBPR, CCA and mental models research combined them in a unique manner in the data analysis stage. The research aimed to be participatory and wanted the participants to critically reflect on the issues, to authentically represent their voice. This was done at the data collection stage. The open-ended mental models interviews ensured that the responses represented inner mental constructs, and I engaged the participants in critical discussion so they could reflect on those mental constructs critically and make connections between structure, culture and agency. This resulted in rich data. At the data analysis stage, as a researcher, I looked at the participants’ discourses and critically analyzed those to understand not only how they represented structural, cultural or agentic issues, but also the interplay. More often than not, individual participants identified those as micro-issues pertaining to their or their immediate family members’ experiences. As a researcher, and analyzing it with a bird’s eye view, I could identify the macro-level connections and could conclude whether, how and why they were affected by the issues of structure, culture and agency. Sometimes, the micro-level identification of the participants and my macro-level conclusions conformed with each other, sometimes they complemented or supplemented each
other, and sometimes they completely differed. The result was a negotiation that I made, as the researcher, and the outcome is a critical analysis of issue from both participants’ and researcher’s combined, but not necessarily mutually agreed-upon perspectives.

**Ensuring trustworthiness of the research**

Qualitative research uses a naturalistic approach that seeks to understand phenomena in context-specific settings, such as ‘*real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest*’ (Patton, 2001, italics added). Qualitative researchers seek illumination, comprehension, and extrapolation to situations (Hoepfl, 1997). Reliability, validity and replicability are concepts intrinsically used in quantitative studies, these terms are not viewed separately in qualitative research. Instead, terminology that encompasses all these three are credibility, transferability, and trustworthiness which are more commonly used in qualitative research (Golafshani, 2003).

The idea of reliability is based on testing the truth behind the findings of any type of research. If the idea of testing is perceived as a way of information elicitation, then the most important test of any qualitative study is its quality. A good qualitative study can help to “*understand a situation that would otherwise be enigmatic or confusing*” (Eisner, 1991). In the context of this research, the underlying aim was to explore the lived experiences and meaning making of community members in Arsenic contaminated villages. This subject has traditionally been studied by natural scientists who believed that handling the physical risk would also change risk perception, and behavior, without noting the challenges people face due to social and political structure, local cultural norms, and personal and collective agency. This research adopted an alternative paradigm to study the subject, to clear up some of the ‘confusions’
scientists and risk managers have had handling this issue.

In a qualitative study, data analysis faces the most criticism. Data analysis methods are mostly subjective and perceived to be largely dependent on researcher’s own judgment. Thus, reliability of a qualitative research cannot be verified conventionally. But reliability is also a relative term and depends on the context under which the research was conducted, and readers’ understanding of that context. As long as the response trends and themes can be traced to fall close to the theoretical frameworks for the research, provide answers to or shed lights on the research questions, and the readers are aptly made aware of the frameworks of the research, the readers would find the research outcome valid and reliable.

Trustworthiness of qualitative studies have always been questioned by positivists who remain skeptical that the conclusions of the qualitative study emerged from the researcher’s positionality within the research topic and the context, and thus the conclusions reflect researcher’s explanations of the responses but not the actual responses. Qualitative researchers have tackled this criticism for long. Guba’s constructs provide parallel criteria to the ones employed by the positivist investigators: a) Credibility in place of internal validity; b) Transferability in place of external validity/generalizability; c) Dependability in place of reliability; and d) Confirmability in place of objectivity) (Guba, 1981; Shenton, 2004).

In the context of this research, the issue of credibility would be demonstrated by presenting the reasons of the challenges the natural scientists and risk managers have faced in risk mitigation in the region. To do that, I used the data collection and analysis methods that have already been used in similar research projects and have been proven to be successful. Community partnership building, interviews and focus groups in the location of the issue, have
all been used for community-based participatory research, mental models research and culture centered approach for long, and thus hoped to be able to credibly bring out the salient points in this research as well. Using multiple methods in tandem increases effectiveness of the individual methods, and makes up for individual limitations of each method when used singularly and separately (Guba, 1981; Brewer & Hunter, 1989). For this research, different methods were used for data collection, such as interviews and focus groups with almost all the groups of stakeholders involved in this issue, visits to contaminated locations, observation of water-drawing behavior, and a thorough formative research that included reading not only academic reports but scientific and policy reports. Through triangulation of all these methods, a true picture is expected to emerge. Lastly, investigating and understanding previous research findings are extremely crucial to be able to evaluate how much the current research’s results are consistent and different with those of past studies. One of the key criterion for evaluating works of qualitative inquiry lies in the researcher’s ability to relate his or her findings to an existing body of knowledge (Silverman (2000). All these methods put together are expected to increase the credibility of the research.

9 External validity (or transferability) “is concerned with the extent to which the findings of one study can be applied to other situations” (Merriam, 1998). To allow transferability, it is important that the researcher sufficiently details out the context of the fieldwork for the readers. This will enable the readers and future researchers to decide if the current situation is similar to another situation and whether the findings can justifiably be applied to the other settings. Guba (1981) recommends that a full description of all the contextual factors impacting the inquiry should be categorically presented. This research has demonstrated a detailed data collection and
analysis methods, and how, in terms of the contextual data, the case study location(s) may compare with other environments (Denscombe, 1998). To increase transferability, the following information have been provided in the methodology section, in the findings and in the discussions: a) the number of people taking part in the study and their context into the study (through demographic data); b) any restrictions in the type of people who contributed data; c) the number of participants involved in the fieldwork; d) detailed recruitment techniques; e) the data collection methods that were employed; f) the number and length of the data collection sessions; g) the time period over which the data was collected, and if the (long/short) time period contributed to the nature of the data collected. However, the notion of realistically producing truly transferable results from a single study is a debated topic in qualitative research. The aim of developing transferable results is not only a probably unrealistic one, but also disregards the role of context in which the research was conducted. Context not only forms a key factor in qualitative research, but it distinguishes itself from more quantitative traditions of inquiry and increases the richness of data.

Fulfilling the dependability criterion is difficult in qualitative research. However, researchers should endeavor to provide enough information about the study to facilitate the future researchers to attempt to repeat the study. Lincoln and Guba (1985) stress the close ties between credibility and dependability, arguing that, in practice, demonstration of the former goes some distance in ensuring the latter. In the current research, the dependability criterion will be addressed by multiple ways: (1) by providing detailed account of the statement and context of the problem, both from objective standpoint and analytical standpoint; (2) by providing detailed context of the participants; and (3) by providing detailed account of the research processes within
which the research was conducted. The detailed contexts will increase the future researchers’ ability to repeat the work within the similar historical, political, economic, structural, cultural contexts. However, this may or may not lead to the same results, as it largely depends on the contexts and the personal lived experiences of the participants. To enable the readers to develop a thorough understanding of the methods and their effectiveness, the methods section includes sections on a) research planning phases, research design, implementations, and challenges; b) the operational details of data collections, specifically focusing on what was done in the field; and c) reflective appraisal of the research, assessing the effectiveness of the process of inquiry.

Learning from the fieldwork has been highlighted in findings, discussions and conclusions chapter, both in terms of what worked and what did not. This sharing of lessons is aimed at facilitating interested future researchers to conduct research in the similar context and subject.

Lastly, to attain confirmability, researchers need to ensure that findings emerge from the data and not only from their own interpretations and predilections. Triangulation has a crucial and effective role of in promoting confirmability, to minimize the susceptibility of investigator’s bias. The key principle of confirmability is that the researcher acknowledges and details out his/her own positionality and predispositions within the context of the research (Miles & Huberman, 1994). By doing this, the researcher also acknowledges the biases he/she might have, in both understanding and interpreting the context of the research and the participants. In the context of the current research, my positionality as an academic researcher of communication, as a member of the population studied had potential to have bias over the research methods I chose, the way I interacted with my respondents and the way I collected and analyzed data. However, throughout the process of the research, I worked with several people who had varying degrees of
understanding of the population, understanding of communication research, or understanding of the methods. Due to their varying background, they helped me deal with predispositions and assumptions with theories, methods and the population. This also helped in triangulation of data collection and analysis, that increase the trustworthiness of the research outcome.

Summary

This chapter provided a detailed analysis of the methodologies, the site of the research and its influence on the choice of the research methods, and the methods adopted for this research, and how the researcher’s position influenced the whole research. In a methodological and process-oriented research such as this, the research process itself bring out rich data which are crucial findings in themselves. Such a descriptive account of the research methods and researcher’s positionality is important in a critical study such as this, as the adopted methods itself determine the nature of the data that could/would be gathered, how data was gathered, and authenticity of the participants’ voice in the data.

Preview of the next chapter

The next chapter will discuss at length the key findings from this research, identify how they situate in the structure, culture and agency or in the interplay of these, and how the participatory research process enriched the findings.
CHAPTER 4 | FINDINGS

In the previous chapter, I discussed how a critical epistemology guided this research and how the discourses were critically analyzed to represent the voices of those who were researched. This chapter presents the analysis of the data from secondary archival research about the water infrastructure and public health infrastructure, and the data from the interviews and focus group from the field work.

In this chapter, I delve into the themes that emerged from people’s voices, and my interpretations of them and tie that with the data from the secondary research to provide contexts to the empirical findings. Secondary research data provides the backdrop of the problem and reveals the dominant narratives against which the people’s voices can be understood in context. Mentioning the secondary research data provides important information about the structure and culture, and collective agency, and how those influence personal agency of the communities.

This chapter is divided into several themes. Dividing this chapter into themes was an iterative process, as themes very integrally tie with each other. They often act as causing, impacting, supplementing, complementing and contradicting factors. Recurring responses were first identified and developed into themes. Thereafter those themes were analyzed as they represented the categories of Culture Centered Approach (CCA): structure, culture and agency. However, multiple themes in these three broad categories were closely intertwined and interrelated. Therefore, strict categorization was not only difficult, but also counter-productive to discuss in a strictly compartmentalized fashion. Instead of organizing the chapter in the three categories of CCA, this chapter is organized as per the themes. This choice was made to duly acknowledge that each theme could represent and identify as issues of structure, culture, and
agency; and also impact each other. In case of the themes that represented more than one broad category, have been repeated, duly acknowledging how those themes cross over between multiple categories; and how multiple categories are nested within one theme or more themes. For example, some themes were causes in one category, an effect in another category, whereas had only a tertiary impact on another. Therefore, it was considered pertinent to mention the three broad categories under the themes and not the other way round, and same responses in multiple themes to enrich the understanding of all the factors that impact risk perception and mitigation behavior.

The result was a descriptive account of what participants said and felt about the issue of water quality and Arsenic contamination, how they connected them with many other issues that preoccupy their lives. The historic, political, economic, social and cultural contexts in which the discourses took place or contexts of the discourses themselves have also been described here. Being an immersive research process, it was hard to remove judgment while describing the discourses. However, the scope of this chapter is limited to describing people’s voices as objectively as possible.

Re-setting the site and scene

This chapter uses a considerable amount of space dwelling on the secondary archival data. This can be perceived as re-setting the site and the scene. The main difference of this information of site and scene from that of the previous chapter is that, while the later provides a more historical context of how the issue of contamination came to exist in the first place and why it was required to study this issue; this chapter provides a more structural and cultural context pertaining to the geographical location and cultural practices as it exists today, and how they
continually impact risk perception and mitigation.

This space provided to the secondary data closely conforms to the requirement and expectations of a study based on culture-centered approach. CCA provides paramount importance in understanding the contexts in which power relations, powerlessness, voicelessness and subjugations of marginalized communities came to be. Traditionally, context has been perceived as “objective” social variables that needs to be known to understand the participants’ discourses. However, it is not only the social situations that influence the structures of domination, but rather the communicative situations in which the participants live and experience their daily lives (Van Dijk, 1998, 2014). Dutta (2015) further argues,

*The conceptualization of communication as culturally rooted meaning is tied to understandings of structure and agency. Structure refers to the systems of organizing the material world that enable and/or constrain access to resources. Structure is connected to the economic bases of social, political, and cultural organizing, being interconnected with the positions of power. Structure gains meaning in the context of culture, the dynamic web of meanings through which community members come to understand their everyday lived experiences and negotiate with structures. This active process of meaning making and figuring out corresponding actions reflects agency.*

The secondary data mentioned here is not the background of contamination, but the contexts which have influenced and impacted individual and collective agency of risk perception and mitigation. For example, without knowing the administrative structure of the democratic and/or bureaucratic systems of governance, one cannot understand the discourses of why, where, and how the (mis)uses of power happen that impedes in providing access of clean water. Without
an understanding of the public health systems in detail, one would question why the health systems cannot immediately tackle the health impacts. One must know how the issues of personal agency is embedded in the traditional gender roles and gender rules of the society; and how the organizational agency of risk mitigation is impeded by the organizational structure itself. This context is also crucial to fully realize how systemic changes can be made and community empowerment can be effected in the micro-level.

In the following sections, I discuss the administrative structure of governance in India, which is also followed in West Bengal. I also provide detailed account of the public health administration, water infrastructure, and traditional food habits and farming practices of West Bengal. I also describe the most common known public health impacts of Arsenic Contamination that have been researched and found in West Bengal, both from scientific and government reports; and doctors’ and participants’ interview data. This detailed account of the context in the next section facilitates understanding of the subsequent sections which is arranged thematically in five subsections: political history of West Bengal, and nature of governance; political favoritism, apathy and corruption; nature and physical qualities of risk; personal agency; and the communicative challenges; and how the complex interplay of these five factors socially construct the risk factors, impede risk perception, and inhibit the personal risk mitigation behaviors.

**The administrative structure of Governance in India:**

India is a quasi-federal country and a quasi-socialist economy, both in constitution and in practice. It is divided into twenty-nine states, and seven union territories. Even though the states have their own administration and enjoy considerable autonomy, the fiscal responsibilities are divided between the union government and state governments. It also follows a quasi-socialist
economic structure, with a combination of restricted market economy, considerable union/state ownership in multiple businesses, and presence of five-year plans. Most of the basic amenities and social services are managed, maintained and provided for by the government. The constitution was developed borrowing elements from British, US and Russian constitutions, therefore it represents elements from administrative, governance and economic structures of all these three countries. Following diagram summarizes the administrative structure and hierarchy:

Figure 4: Administrative Structure of India
Distribution of administrative and financial responsibilities: At the apex is the federal or union government of India, and directly under this are the state governments. As far as the financial responsibilities go, there are three types of financial responsibilities, divided in three lists in the constitution: the central list (federal responsibilities, such as income tax); the state list (state responsibilities, such as property tax, agricultural and much of sales tax); and the concurrent list (responsibilities are divided: state collects taxes and central government provides and maintains the infrastructure, such as health, part of education, and national highways).

Role of Panchayat: Even though this structure follows the ancient Indian governance structure practiced for centuries, the Panchayat Raj structure was introduced more formally in 1992 via Constitutional Amendment number 73. This amendment mandated and regularized regular elections for Gram Panchayats (village-level local self-government), provided autonomous political and financial governance, and local area development roles for the elected members at the village level. To encourage more women participation, in the following year in 1993, another constitutional amendment was passed to include 33% reservation for women in the positions of Gram Panchayat Pradhan or chief of Gram Panchayat. Since 2008, this rule is being strictly enforced.

Gram Panchayats are responsible for day-to-day development of the villages, including developing, managing and maintaining infrastructure such as water, sanitation, hygiene, maintenance of elementary schools under Sarva Sikha Abhiyan, and the mid-day meal at schools. Sarva Shiksha Abhiyan (SSA) is the Government of India's flagship program for achievement of Universalization of Elementary Education (UEE) in a time bound manner, as mandated by the 86th amendment to the Constitution of India through the Right to Education Act in 2002. This
Act made free and compulsory education for children aged between 6 and 14 a Fundamental Right under the constitution. SSA is implemented in partnership with State Governments and Gram Panchayats are the responsible agencies to disburse money to individual schools.

**Water Resources Administration:** The Central Groundwater Board is a federal agency which is responsible for testing for overall groundwater quality of the country. They have state-level representatives who are responsible for administration of water infrastructure in individual states. At the district, block and village levels, Public Health Engineering Department (PHED) takes care of village level water testing and providing of clean water. PHED is directly under the Block Development Office, and is officiated by the Block Development Officer who is a civil servant and a bureaucrat.

**Public Health Administration**

Public health is a joint responsibility of the federal government and state government. In 2005, the federal government launched a flagship project, The National Rural Health Mission to provide accessible, affordable and quality health care to the rural population, especially the

![Figure 5: Administrative structure of the National Rural Health Mission (NRHM)](image-url)
vulnerable groups. The program is being implemented with the help of state agencies at all levels of administration.

The district hospitals provide almost all facilities of diagnosis and certain invasive procedures as well, but may not have treatment for very serious and chronic diseases. In those cases, people have to travel to urban hospitals in metropolitan or state capitals cities which have better infrastructure. Community health centers are staffed by one or two doctors, and have an appellate role beyond prenatal and postnatal maternal and child healthcare facilities, vaginal and C-section deliveries, basic diagnosis of diseases, and family planning surgeries. Primary Health Centers may be staffed by one or two doctors, have an out-patient ward, and also perform an appellate role. These health centers bridge the gap between immediate health necessities and more serious health needs. Sub-centers are not staffed by doctors, but Ancillary Nurse Midwives (ANMs) and cater to first-aid, medicine for snake-bite, vaccines and family planning. Even though there is no formal structure below the sub-center levels, the most important part of the NRHM are the Accredited Social Health Activist or more commonly known with their acronym ASHA (interestingly, ASHA means hope in Hindi and Bengali) and the Anganwadi workers who directly report to the ANMs in the subcenters. These primary health workers are the most crucial link between the village communities and the long hierarchical chain of public health administration. These workers provide informational service door to door, primarily about maternal and child health, family planning, personal health and hygiene. They also take the pregnant ladies for hospital delivery. While the other medical personnel get monthly salary for their work, ASHA/ Anganwadi workers get performance-based incentives.

This context of the administrative and public health structure is important for two
primary reasons: this structure helps to identify the locus of power in the patient-provider relationship, and gives an idea of probable geographic locations of primary health centers. The administrative structure diagram reveals that proper medical facilities are only available in larger villages, or district headquarters which also means that these hospitals cater to a lot of people from a large geographic area, thereby raising a question on the quality of healthcare that can be provided to each individual patient. In larger districts, such as North 24 Paraganas where the research was conducted, there are many villages which are located far from the district headquarters and the district hospitals. This indicates the issues of availability, and quality of healthcare the village communities have access to. This is very pertinent to our discussion of mitigation in subsequent sections.

**Water infrastructure**

There are four major issues with water infrastructure in the villages- access, availability, quantity and quality. The first three factors pose such great challenges that villagers are little or not concerned about water quality.

Water infrastructure in villages is poor and insufficient in most places. Piped water connections to individual households is not prevalent in any of the fourteen villages that were visited. Household connections are limited to urban areas of West Bengal, and in district headquarters. Out of the villages that were visited, the nearest village was around 16 miles away from the district headquarters. The greater the distance the villages were located from the district
headquarters, water infrastructure was poorer. In rural areas, groundwater is primarily drawn from three sources: household tubewells, community tubewells, and community piped water connections. The household tubewells are installed by the individual house owners and are installed within the house premises. These are usually shallow, around 50-100 feet in depth. These kinds of shallow tubewells were found to be the most vulnerable to being contaminated with Arsenic. In places where alternative sources of water were available, these tubewells were used for cleaning, washing, sweeping, bathing and watering cattle.

Community water points, such as tubewells and piped connections are installed by the government authorities, usually the block development office, and are directly under the budget of state governments, or the local self-government (the Panchayat). These community tubewells and community water pipes are installed at a common location that can be accessed by all the community members. The locations are decided by the Block Development Office based on the population of the neighborhoods. Community tubewells are usually deeper, between 150-250 feet or deeper, up to 800 feet. Community piped connections may supply water from two types of sources: from a very deep tubewell of upto 1200 feet depth, installed at a central location (most commonly at the Block Development Office), or purified water from a surface water source.

Of the fourteen villages visited, six villages were found to have access to community piped connections. The majority of these connections supplied groundwater drawn from a deep tubewell and purified by a water purifier installed by the Public Works Department (PWD), or Public Health Engineering department (PHED). Four of these purifiers purified water of Arsenic, and two only purified for bacteria. In all the six villages where block development office
supplied water from a water purifier, I asked about the quality of the water and if they knew any
details about the water purifiers. One 54-year old male participant elaborated,

“I have seen the water purifier. You can see it from the road. It is big and has many
pipes. I never asked what it does. I am afraid that might make the authorities angry and we will
lose whatever little we have. I just trust it”.

This participant voiced the concern of being reprimanded for asking and identified the
position of powerlessness among the community members. Another male participant in his 20s
who often went to work near the block office said:

“I think it cleanse Arsenic. Isn’t it obvious that’s why it’s there? But who really knows?”

This participant also voiced ignorance, and lack of personal agency in knowing about the
water sources. As I probed few other participants, none of them knew what the purifiers actually
did and whether the water was Arsenic-safe. They also feared that their curiosity will have dire
consequences and they will lose their limited privilege as well. Therefore, they chose to trust the
system and used the water without doubt. They also considered that if they doubt the quality of
the water or if they knew that the water was not safe, they would not have any other source of
clean water. So, they preferred ignorance over knowledge for what they saw as their benefit.

In the North 24 Paraganas district, only one surface water purifying plant exists which
purifies water from the river Ganges and supplies the water mainly to Kolkata Metropolitan
Areas, the state capital region. The water purifying plant is located about 10 miles from the
district headquarters. A part of the purified Ganges water is also supplied through pipelines to a
few impoverished border towns in the India-Bangladesh border areas, both in North and South
24 Paraganas districts. These pipelines run through few villages in North 24 Paraganas which
were visited as part of this study. Water is released from the main purifying plant three times a day, is stored in overhead reservoirs located on the way, and released at different locations following a scheduled roster. Among the fourteen villages visited, only in two villages were these water connections legally provided by the Block Development Offices. In many other villages, the main supply water pipeline was illegally tapped into to withdraw water. Villagers neither had knowledge about the scheduled roster, nor did they pay for the water they withdrew. Illegal tapping was communally done and agreed upon. In most cases, the Block Development Office and local police were aware of this illegal tapping. They either did not take any action, or took money from the villages and allowed the practice to continue illegally. This illegal tapping poses a lot of threat to water quality and quantity: it exposes the water pipeline to contaminants and bacterial pollution; it leads to water wastage; and it makes the overall infrastructure of pipeline vulnerable and prone to early breakage.

Regardless of the type of water supply and how water was received, community piped connections were irregular and unreliable in nature, and could be accessed only at fixed times, usually two-three times in a day, and only for two-three hours each time. Often, the scheduled roster was not strictly followed and there would be days when water would not be released at all. In fear of this, people often stored extra water on the days they had access to water. This created tremendous pressure on the pipes, and resulted in frequent malfunction of the pipes and breakage. People would have to wait for hours to fetch water. Often, they would start queuing up hours before the scheduled time. Being a communal property, some behaviors illustrated the concept commonly known as the tragedy of the commons. Nobody would take initiative to carefully use the pipes or act proactively to fix the pipes in case of breakage. They simply went
back to using their household tubewells’ connections which increases susceptibility to contamination.

Since the community tubewells were accessed by an entire neighborhood or sometimes more than one neighborhood, villagers usually had to wait in long queues to fetch water, and there were community discords in water fetching. Incidents of violent communal clashes at the water collection points are quite common and frequent in different parts of India, including West Bengal. However, villagers in none of the villages where the study was conducted mentioned any such serious discord in their immediate past, though they often feared such incidents. Communal clashes between Hindu and Muslim communities, or different castes of Hindus are also quite common in other parts of West Bengal and India. However, such incidents were also not mentioned by any of the participants. Despite that, tensions were evident in the way people talked about water drawing habits of different households. People would repeatedly make mention of the number of people and cattle in other households, how many times they queue up to fetch water, how much water they fetch each time, how they help maintain (or not) the water points, and such. There would always be an overtone of anger in the participants’ voices. One 39-year old female participant particularly showed her discord. She repeatedly blamed her neighbor and a relative for fetching too much water:

“Every time water comes (meaning when water was released from the main source point), she would fetch buckets of water. I don’t know what they do with all those water. They are just three people, but they need so much water. They have three cows. We asked them to sell the cows as it creates problems for us, but they did not. I think they feed the cows this good water. She is arrogant.”
Another 61-year old (Hindu) male participant mentioned of his neighbor:

“You know they (referring to the Muslim families) always have such big families. Naturally, they need more water. They have big families so that they can control the resources more.”

More often than not, these allegations, of over extraction of water, or use of resources are baseless and without any proof. When I asked them if they ever had any discussions with their neighbors about mutually-agreeable and responsible water-drawing behaviors, they mentioned that they never discuss about water to other people as it might lead to serious discord issues. Rather they always hope that the authorities will improve the infrastructure.

Infrastructure development for safer water faces multiple challenges. Geophysically, West Bengal is a water-rich state. Even though West Bengal has many rivers flowing through it, however, none of these rivers originate in West Bengal. West Bengal, especially the southern West Bengal is in the low lands, and is the mouth of the ocean, Bay of Bengal. The rivers originate in the northern high lands, in the Himalayas and in Chota Nagpur plateau (in the neighboring states of Bihar and Jharkhand), and flow through multiple Indian states before entering West Bengal. By the time the rivers enter West Bengal, they are full of silt and highly polluted. Due to the proximity to Bay of Bengal, many of the rivers are also fed by tidal sea water which increases the salinity in the water. All these factors make water purification a lengthy and expensive process, and a major financial investment. Additionally, many of these rivers are rain-fed. Therefore, constant and reliable supply of surface water throughout the year is also a challenge. Coupled with this, economic impoverishment of the state and local governments makes it hard to install large centralized or decentralized water purification plants.
for purifying surface water. This has further increased dependence on groundwater and challenge risk mitigation.

Physical characteristics of groundwater aquifers in West Bengal poses additional challenges with water infrastructure. The geologists and engineers in the Public Health Engineering Department (PHED), the main agency responsible for water infrastructure at the village-level have repeatedly found that while drilling for new and deeper tubewells, an Arsenic-free layer is hard to reach at the most preferred or designated areas. Often the water in deep layers up to 500 feet is found to be contaminated with Arsenic. Certain locations are unsuitable to have a community tubewell installed, and may have possibilities for contamination from other sources such as agricultural run-off, household water run-off, cowsheds and certain open fields that are often still used for open defecation in the rural areas. The tubewells need to be installed in the public land, to ensure there is no private claim on the tubewells. These geological, and anthropogenic factors, coupled with economic constraints, result in the community tubewells or the piped water access points to be installed at infrequent intervals in a neighborhood or a village, or in locations which are not easily accessible by community members. Often the water points are installed in village schools, village temples and mosques, or near the public health center as these are usually located on public lands, and thus it ensures easy public access.

These limitations in creating the water infrastructure, limits the effective capacities of the communities to access contaminant free safe water. Along with these structural challenges, several cultural challenges remain. Culturally, women are primarily responsible to fetch water. Women in rural areas do not drive cars and the majority of them also do not ride bicycles. If the water access point is far, it is difficult for women to fetch enough water required for the family.
These dynamics of limited or restricted access to water pose multiple challenges in adopting Arsenic-free safe water behavior. In many households, families still live in a large joint family, with multiple elderly and young members who cannot fetch water for themselves. Therefore, while the required amount of water for the family is very high, the amount that can be fetched for per member of the household is limited. In families with higher number of older people and children, the quantity of water that could be fetched for each consumer turns out to be even less. Cultural norms prevail in the practice of setting aside cleaner water for older people and the young. In villages where safe water points are limited, people use Arsenic-free water only for drinking and cooking rice, but continue to use contaminated water for all other purposes. Such practices are even higher among capable adults, and especially women who due to their nurturing role keep the best of everything for their families while they continue to use contaminated water, seriously compromising their health.

The Public Health Engineering Department (PHED) of the Government of West Bengal is responsible for checking for Arsenic in water and for providing purified water. PHED is housed under the Block Development Office and builds water infrastructure for contamination removal. PHED installs small Arsenic removal plants in the community water points in those locations where Arsenic contamination is very high and it is hard to find an Arsenic-free layer of water. A number of such Arsenic removal plants were installed in many villages. However, filters in these plants get easily deposited with Arsenic and clogged with dirt particles when frequently used. After a certain time, these filters need removal and installation of new filters. Maintenance of these Arsenic removal plants often are much neglected. There is no fixed scheduling and record-maintenance for checking of the filters. Neither PHED nor community
members check for deposit of Arsenic in the filters. PHED engineers or their representatives seldom go to check the Arsenic deposits in the filters.

PHED also coordinates testing of household and community tubewells for presence of contaminants including Arsenic. If community tubewells are found to be above the permissible limit of Arsenic, the tubewells are marked red. However, such practice is not always followed in case of household tubewells. Households are informed of the water testing results only when the test results show serious concern. The Block Development Offices are responsible for water testing. However, there is no easy system or quick turn over time if villagers themselves go and submit the water sample to the Block Development Office. Every Block Development Office does not even have a water testing facility, and water is taken to the District headquarter or another Block Development Office for testing. Villagers have limited access and knowledge of where to go for water testing. The water infrastructure increases susceptibility for contamination, and challenges personal mitigation behavior.

Traditional Food habits and Farming Practices

Along with the water infrastructure, the traditional cultural practices of farming and food habits also increase susceptibility to exposure to Arsenic. India as a whole, and Bengal in specific has always been an agrarian economy. The main crops that are produced in West Bengal are rice,

Figure 7: Groundwater Irrigation in West Bengal. Photo Credit: IWMI (Creative Commons License)
potato, jute, sugarcane and wheat.

The traditional staple diet of Bengali community is rice, fish, different types of lentil soups and vegetables. The variety of rice that is traditionally eaten, especially in rural areas are locally grown parboiled rice. Parboiling involves partial boiling of rice in the husk before milling, to increase its nutritional value, to change the texture of cooked rice, and reduce the breakage in milling. Parboiling is done in three steps: Soaking, steaming and drying. Other staple food which are eaten are wild-grown leaves, chicken meat, duck meat, goat meat and beef. Chicken meat, duck meat, and goat meat are common in both Hindu and Muslim communities, whereas beef is eaten only by the Muslim communities. The traditional food patterns, and farming practices add to the contamination risks.

The main two crops of the region, rice paddy and jute are both extremely water-intensive crops, and farming takes place primarily by using groundwater irrigation pumps. Since both rice and jute plants are cultivated in standing water and primarily in the summer months, it is not feasible to depend on rainwater for irrigation. Since the 1950s, groundwater has been steadily used for irrigation and farming. Susceptibility to chronic contamination by the farmers also
increases due to these labor-intensive processes. Even though tractors have been introduced for ploughing land, many of the subsistent farmers still use bulls or buffalos for ploughing. This increases exposure of both humans and animals into the contaminated soil. In addition, in case of manual (human and animal) ploughing, it is almost impossible to wear footwear or hand gloves. These traditional farming practices greatly increase farmers’ susceptibility to contamination through continued exposure to Arsenic-contaminated water and soil.

The entire timeline of rice farming, such as sowing, ploughing and harvesting is a water intensive and labor-intensive process. This is especially crucial because, unlike wheat, rice harvesting cannot be done mechanically. In addition to this, the parboiling process also adds to the susceptibility of exposure to contaminated water (IRRI, 2017).
As evidenced from the above pictures, every step from paddy cultivation to rice production is water-intensive and requires touching of the water and soil by hand. This way, it increases the vulnerability of those engaged in the process to get contaminated if the water and soil are contaminated.

Jute production, the other main crop in West Bengal also follows a water intensive process. Jute is primarily grown for the soft fiber for making sacks which is used for transporting food grains, vegetables, sawdust, small woods, and many other hardware items. It is also being increasingly used in the fashion industry. In the beginning of the raining season, jute husks are taken out to be soaked in standing water. After a few days, the soft fibers come out from the
inside of the stems. They are then separated by hand, and left for drying before they are turned into yarns. Following are few images depicting the jute cultivation in West Bengal.

The above pictures show evidences that jute cultivation, much like rice cultivation, greatly exposes the farmers to water and soil, and can easily contaminate them when the water and soil are contaminated. Absorption of Arsenic into human and animal body happens not only through actual consumption through mouth, but also by touching. These water-intensive farming practices, therefore, greatly increases susceptibility to contamination, and challenge mitigation.

Along with the traditional farming practices, consumption of rice is another contributing factor in Arsenic contamination. Several scientific studies have found that rice easily absorbs any contaminant that is present in the soil and the water (Abedin, Cotter-Howells & Meharg, 2002; Zavala & Duxbury, 2008; Meharg & Zhao, 2012). It is also accepted that green leaves absorb more contaminants from water than fruits of those trees. This happens because water is transported through the stems and reaches leaf veins and gets most absorbed in the leaves (McBride, Simon, & Wharton, 2013; McBride, Shayler, Russell-Anelli, Sliethoff, & Marquez-Bravo, 2015). Among meat items, fish absorb the least Arsenic, even though mercury and bacterial contamination of fish is problematic. Chicken and goats consume less water; therefore,
their muscle tissues absorb less water. Arsenic contamination and absorption is the highest among beef, due to high water consumption and absorption. Muscle tissues and fat retain the maximum contaminants (Abernathy, Thomas, & Calderon, 2003; Faires, 2004).

Every participant was extensively asked about their food habits during field work for this project. All participants mentioned that rice is their staple diet. Most families eat rice multiple times a day, most commonly between 2 to 4 times every day. Rice is staple for lunch, along with lentil soup, and other vegetables such as jute leaves and other leafy vegetables such as green spinach, red spinach, Basella alba (an edible perennial vine in the family Basellaceae, native to South Asia), white radish leaf and many other local varieties of leafy vegetables that absorb more contaminants from water than other vegetables. Meat consumption is also common among the Bengali community. Fish is eaten most commonly. Among other meat, chicken is most commonly consumed by the Hindu communities. Occasionally, they also eat goat meat. Beef consumption is quite common and high among Muslim communities. These food habits significantly increase the susceptibility of contamination through food items. However, the responses of the people during the study evidenced that people are not aware of their susceptibility to contamination due to these specific food habits. They have never been informed about how their traditional food habits may expose them to contamination, nor have they ever been asked to make any changes in their food habits. This diet is not only due to tradition, but also of convenience. Rice is locally grown, and less expensive. One 71-year old male participant with skin lesions reflected:

“I have grown up eating rice. I eat rice for breakfast, lunch and dinner. I eat muri (puffed rice, a common snack) for evening snack. This is what is available to us, this is what we grow.
We are rice farmers. If we eat rice, we sustain ourselves from our own produce and we don’t have to purchase from the markets. But if we have to eat ruti (wheat based flatbread), we have to buy it. We don’t have the money for that.”

Another female participant in her late 50s talked about the leafy vegetables:

“My husband and sons have to go out to work early in the morning. Most days they don’t have time to go to the market to buy vegetables. So, I make leafy vegetables and lentil soup. My mother-grandmother always said green leaves are good for eyes. I still don’t wear glasses. Leafy vegetables give us nutrition and save lives. We can never stop eating it.”

The traditional food patterns are not only convenient, less expensive, and part of age-old habits, but people also have emotional connections with food. As a child, I read a poem in Bengali, in which a boatman was visited by a Goddess. She asked him that he could ask for any boon. All the boatman asked was, *amar santan jeno thake doodhe bhaate* (bless that my children never face shortage of rice and milk). During one of the interviews, one participant made a mention of this poem and joked that the boatman could ask for bread and meat, but he asked for rice and milk because that represents the cultural pulse of Bengal. This emotional connection, along with low price and easy availability of rice and leafy vegetables, increases susceptibility to contamination. At the same, this emotionality poses additional challenge in mitigation.

**Public health Impacts of Arsenic Contamination**

Contamination through Arsenic has multiple, far and wide impacts on human and animal health. This section primarily focuses on impact on human health, and briefly discusses impact on animal health as it pertains to impact on human health.

Continued consumption of Arsenic-contaminated water or food items may have wide-
ranging impact on human health. The intensity of the impact depends on several factors. Some of these are: (1) amount of Arsenic in water and food items, (2) duration of drinking Arsenic-contaminated water/eating contaminated food, (3) frequency of drinking/eating, (4) food habits and specific diets, (5) range of exposure to contaminated water and soil other than direct consumption. The health effects range from mild skin lesions to multiple organ failure and cancer, often leading to death. Arsenicosis is used as an umbrella term to indicate the complications due to elevated levels of Arsenic in the body, through continued consumption of Arsenic contaminated food items or water for 5-20 years, or due to direct skin contact with chemical Arsenic contaminated water/soil (Rahman, Ng, & Naidu, 2009). The most common and first level of manifestation of contamination are noticeable dermatological features such as melanosis (black/white pigmentation of skin), and keratosis (rough, dry, papular skin lesions). Melanosis looks like raindrop pigmentation and may be first spotted over chest, back and limbs. If arsenic exposure continues, Melanosis may spread in palms, soles and later in the whole body. Leucomelanosis is pigmentation and depigmentation, i.e. black and white spots side by side that usually appears in later stages after discontinuing consumption of contaminated water (Kapaj, Peterson, Liber, & Bhattacharya, 2006). Guttate melanosis looks like big black mole may sometimes be found. In Buccal mucus membrane melanosis, diffuse and patchy spots may also be observed on the tongue, gums and lips. These dermatological features are early signs of Arsenic contamination, and vary widely depending on consumption (Kapaj, Peterson, Liber, & Bhattacharya, 2006).

However, if contamination continues, these may lead to more serious cases. Dermatological moles may get enlarged into large nodules which are often precursor to skin
cancer. Another early form skin cancer due to Arsenicosis is Bowen’s disease, a premalignant skin condition also called squamous cell carcinoma in situ (Morton, & Dunnette, 1994). The main manifestation is through red, scaly patches on the skin. It affects the squamous cells – which are in the outermost layer of skin. Bowen's disease can eventually develop into a different type of skin cancer called squamous cell skin cancer if it's left undiagnosed or neglected (Rahman, Chowdhury, Mukherjee, Mondal, Paul, Lodh, Biswas, Chanda, Basu, Saha, & Roy, 2001). Different forms of skin ulcer are late features of cutaneous Arsenicosis that may turn into malignancy if remain untreated and develop into serious skin cancers. Skin ulcers have caused gangrene, limb amputation, and malignant skin ulcers have also caused death. People with a poor nutritional status were more vulnerable to being contamination and greater effect of contamination in their body (Ratnaike, 2003).

Arsenic toxicity and poisoning may also cause several complications in inner organs, such as cancers of lung, bladder and kidney, and other internal tumors. Studies show that the highest concentration of Arsenic is in the kidneys and liver (Benramdane, Accominotti, Fanton, Malicier, & Vallon, 1999). In chronic arsenic ingestion, arsenic accumulates in the liver, kidneys, heart, and lungs and smaller amounts in the muscles, nervous system, gastrointestinal tract, and spleen (Benramdane et al., 1999). About 50% of the ingested dose may be eliminated through the urine in three to five days and a small amount of inorganic Arsenic is also excreted (Hopenhaynrich, Smith & Goeden, 1993). Sweating has also been found to an effective method of detoxification of body from Arsenic (Sears, Kerr, & Bray, 2012).

There are many other physiological side-effects of skin pigmentation. Patients with arsenical skin lesions report sensation of severe pruritus or prickly heat on exposure to sunlight,
even in winter. Their skin becomes very sensitive to the sun. Too much exposure to the sun increases the irritation and ulcers get worse (Ratnaike, 2003). Quite strangely, face is usually not affected by Arsenical skin lesions. Scientists have found very few cases of diffuse melanosis on the face (Ratnaike, 2003). However, there are more cases of melanosis or nodular growth on the skin of the skull. Of the participants in the field work, one person showed unique manifestations of Arsenicosis. A 41-year old male participant had a nodular growth in his forehead and also in his skull. The nodular growth in the skull skin developed into a malignant tumor. The effect of the growth was penetrative inside the skull, and a part of his skull muscles had to be removed. This caused temporary amnesia, loss of control over some of the limbs and chronic fatigue. He shared:

"Our family profession was digging and construction of dug wells. In recent days, people do not use so much of dug wells, business is bad, so we moved into digging ponds, irrigation canals, etc. But these are very strenuous jobs. This was a family business. Then our older brother died of Arsenic, one brother lost his left leg and fingers, and I had to get my skull operated. I can't do strenuous job any longer. So, I took up banana business. I have to employ people because I can't carry any load, and I have to pay them as well which cuts down the profit. I do ride the cycle van sometimes, but most of the times my son does that. All I do is sit in one place and sell banana. But, you see, our family business was not selling to customers, so I can't talk the customers into buying bananas. This is almost hopeless. I don't know how things will be in a few years as I am losing my strength every day."

This participant had a daughter and a son. The daughter was married, and the son was still young. In the traditional culture of rural Bengal, neither the daughter nor the wife can take
up or help him out in the business. When I asked the wife about helping her husband in the business, his wife said,

"I think I have to start working as maidservant."

Then I asked, "why can you not help him in the business? That would be better than working at someone else's house".

In the answer, she said, "Bajaar Marader Jayga. Khali baje meyera Bajaare jay (the market is the place for men. Only bad girls go to the market).

She literally meant that the only time women go to market as a ‘seller’ is to sell themselves indicating prostitution. In the cultural context of Bengal, the concept of working women is not common, and almost non-existent in rural areas. If a man cannot fend for his wife and the wife must go out to work, that means a loss of face for the husband and the family. However, even though the number is unknown, there are thousands of women who work as maidservants in multipurpose jobs in other people's households. Being a maidservant is not frowned upon as much as the woman still remains within the household, even if it is someone else's household. At the same time, this shuns their vertical growth.

Other symptoms are conjunctival congestion and burning sensation of eyes. Congestion of the eyes creates a sensation of painful burning and itching in the eye, with thickening of the eyelids leading to a feeling of heaviness and weight in the eyes. The blood-vessels inside the eyes get swollen and turns the white of the eye reddened. The eyes are often watery. These symptoms generally get worse when exposed to a strong light, including sunlight. This remains in this condition for years, and may remain forever (Milton, Hasan, Rahman, & Rahman, 2001). The reddening of the eyes had social costs on the people who developed it. A 31-year old male
participant who developed conjunctival congestion in his mid-teens mentioned:

“We are traditionally farmers. But, I cannot work in the fields for long because it burns my eyes, and after a point, I cannot keep my eye open. So, I changed my profession into driving a van for a factory. It’s not great income, but I can also work after sunset. I can wear sunglasses, even though that does not help much. Plus, people laugh at me when I do that (wearing sunglasses), it’s not a common custom to wear sunglasses in these poor rural areas. I had so much difficulty getting married. Because of my reddened eyes, people would think I am drunk all the time. It’s hard to explain to someone who does not know what caused it.”

He mentioned that he earns much less than what he used to earn through farming. In addition, it is not guaranteed that he would get work every day. The competition in driving factory vans is high. Nowadays, young boys are not interested in farming. So, they take up to driving as it is easy to do. But this participant, who learnt farming through his father and uncles and skilled, thinks it is a waste of his skills to not be able to do farming. Also, he feels guilty of not being able to earn enough for his family.

Such instances of loss of traditional livelihood due to Arsenic contamination is not uncommon and has other consequences on personal and social lives as well. The skin lesions are generally the first manifestations of Arsenic contamination in the body. In addition, many participants complained of chronic fatigue and many other health problems. Neurological examinations were conducted by doctors on Arsenicosis patients whose skin lesions were diagnosed by dermatologists. Several neuropathic problems were found in the Arsenicosis patients, such as (i) sensations of chronic pain, burning, tingling or pricking by pins and needles (medically termed as paraesthesia) in the stocking and glove distribution of the peripheral nerves,
(ii) numbness, (iii) hyperpathia/allodynia wherein certain stimuli including chemicals causes sensory nervous system to evoke exaggerated levels of pain, (iv) affected/reduced/absent perception of sensation to pinprick, vibratory perception, joint-position sensation or touch sensation (medically termed distal hypesthesias), (v) calf tenderness, (vi) weakness/atrophy of distal limb muscles or gait disorder, and (vii) reduction or absence of tendonflexes (Milton, et al, 2001; Rahman et al, 2009).

Doctors found that continued Arsenic exposure through direct consumption of water may cause variable levels of obstetric problems. Doctors have found several cases with adverse effects in pregnancy outcomes, such as spontaneous and repeated miscarriage, preterm birth, stillbirths, low birth weight, and neonatal and perinatal mortality (Milton, et al, 2001; Rahman et al, 2009). I found several women who had experienced miscarriages in their youth, and could not ultimately bear children. Even if they have never been told this was due to Arsenic contamination, a connection can be made with Arsenic as a contributing factor.

Other common health problems due to Arsenicosis are chronic diarrhea and heart-burn; non-malignant chronic liver diseases such as non-cirrhotic portal fibrosis, incomplete septal cirrhosis, and variceal bleeding; myocardial injury; hyperglycemia or elevated blood sugar levels; restrictive and obstructive lung disease; nephritis and prostate cancer; orthopaedic problems and pain in the joints, solid edema or permanent swelling of feet (Ratnaike, 2003).

Even though scientists have not been able to completely confirm it, there is evidence that Arsenic adversely affects DNA repair. It adversely affects methylation of DNA, the mechanism human body cells use to control gene expression. Further Arsenic contamination adversely alters lipids, proteins, and DNA, medically known as increased free radical formation that trigger
several chronic human diseases. Arsenic may act as a co-carcinogen, tumor promoter, or tumor catalyst under certain circumstances. Despite multiple evidences of chronic health effects of Arsenic contamination, scientists have considerable uncertainty regarding the amount and duration of consumption of Arsenic that may lead to health problems, and what kind of consumption patterns lead to Arsenicosis (Ratnaike, 2003). This uncertainty, along with physical qualities of risk significantly impede both governments’ and people’s risk mitigation endeavors.

These chronic medical conditions got worsened by the lack of health infrastructure in the villages which has been already discussed earlier in this chapter. The primary healthcare system in villages is poor. Majority of the villages I visited did not have a primary health care center within the village. Therefore, people relied on local doctors who often did not have any medical degree. Many of these ‘local doctors’ used to assist medical doctors in the city or the district headquarter, and gained experience in medicine. They are known as the ‘compounders’, even though they were not as qualified as actual medical compounders. A medical compounder is a doctor’s medical assistant who mixes or combines ingredients in order to produce a medicine, or other substance. These local doctors used to be assistants of homeopathic doctors, or they worked in a allopathic doctor’s clinic but they may or may not have actual medical assistant’s training. These local doctors or quacks only had knowledge about basic medicine and necessary first-aid for cough, cold, fever, aches, basic injury, and some vaccines. They did not have diagnostic knowledge of any serious illnesses, nor could they treat those. But in the absence of healthcare facilities in the villages, many villagers depend on these quacks. Unaware of the actual medical qualification of these untrained doctors, or quacks, many people trust their treatment and never seek help from trained doctors. This lapse in timely treatment of ailments
often complicates the effects of contamination in one’s body. There have been evidences of people seeking medical attention in bigger hospitals only when they were not being cured by the untrained local doctors. They often sought help when the contamination penetrated their body too much, and it became incurable. However, the patients thought that the doctors could not cure it, and lost their trust in the doctors. Since the local doctors mostly only gave pain-killers, the patients got temporary relief. Therefore, they considered that treatment more effective than the slow curing process followed by the actual doctors. Consequently, people continued to consult the local quacks and refused to go to actual doctors. The easy accessibility and approachability of the local doctors vis-à-vis the actual doctors was also a contributing factor in this. I asked one untrained doctor or quack if he ever faced ethical dilemma in not disclosing his medical qualification. He pointed out:

“I don’t face ethical dilemma. I don’t claim that I can cure big diseases. I know people call me doctor, that is out of respect. I don’t think people actually believe I am a trained doctor. I prescribe only those medicines which do not have long-term side-effects. I don’t have attitude like doctors, I don’t take a lot of money, I do a lot of charity. I also do house visits if someone cannot visit me. I talk to them and try to understand their issues. I don’t treat diseases, I treat their agonies. I feel good that I’m able to at least lessen their pain when they feel it.”

Even when a village has a sub-center or a primary health center, it is not staffed by a doctor, but nurses. Even though the nurses are trained, they are not specialized nurses, and cannot do any diagnosis. The primary healthcare infrastructure in the rural areas can take care of basic ailments, such as maternal and child health, family planning, personal and community hygiene, and immunization, but do not have capacities for any diagnosis or invasive procedures,
and seriously lack diagnosis capacities of serious and chronic ailments, such as those emanating from Arsenic contamination. If people require treatment for serious diseases, they must either visit a sub-divisional/ block hospital. These hospitals had better capacities to detect whether a disease is a serious chronic disease or an easily treatable one, but also lack capacities to diagnose the actual nature of the disease. District hospitals are also no better. District hospitals may have basic operative infrastructure, but they cannot do any long-term medication for which people are referred to the main four hospitals in Kolkata, which is in average a distance of 20-60 miles from the different locations in the North 24 Paraganas district. But for the villagers, this is a significant distance given that they do not have their own conveyance and have to rely on public transport. Women cannot travel alone and have to be accompanied by a male. For the males, traveling to Kolkata and spending a day to visit the doctor would mean loss of one day’s wages which is, for many families, hard to miss. In addition, they are also not sure if they will be able to visit the doctor in the hospitals due to great rush in the public hospitals. One participant pointed out, “I never go to the city to see the doctor. It is too far away. Plus, if I am diagnosed with a disease, and I have to be admitted to the hospital, who will take care of the family and the farm? So, when I feel pain, I go the doctor (referring to the local doctor), take some pain medicine and I feel better for few days. I had someone from our Para (neighborhood) go to the city hospital, and never came back (meaning that he died in the hospital)”.

Even though the government-run medical facilities provide a lot of services free of cost, there are many hidden costs of seeking medical advice or treatment for medical facilities in the city. The primary demotivating factor for people to go to the city for treatment is missing workdays, travel costs, cost of food and partial medical cost. Even if the actual medical cost is
minimal, people’s perceptions about medical expenses are influenced negatively by fallacious stories they have heard from others.

Another contributing factor that dissuades people from seeking medical help from anyone other than local doctors is lack of trust in Western medicine and western medical facilities. Several participants indicated their fear of side effects in Western medicine, and their own experience of side-effects. They fear impotency, infertility, birth defects in future generation and addiction to medicine. They also fear that some of the ingredients in the medicine might be prohibited in their religion, for example beef for Hindus and pork and alcohol for Muslims. Several participants preferred homeopathic medicine as it is grounded and personalized by the doctor in front of the patients. Irrespective of the religious affiliation, people also had high trust in Ayurvedic medicine (an ancient medicinal practice tied with Hindu religion and philosophy) and strongly believed that neither homeopathic medicine nor Ayurvedic medicine would have any side effects. One participant pointed out:

“The (city) doctor gave me this medicine which did not work for me. So, I stopped going to him. My pain and itching would not stop and I could not go out in the sun because of the itching. Then, Rosul (referring to a neighbor) told me about an Ayurvedic doctor in Salt Lake (an upmarket neighborhood in Kolkata). Though he takes a lot of money, I am much better now. The itching is better. I no longer feel tired all the time.”

This male participant was in his late 60s, and had been drinking Arsenic-contaminated water for almost 40 years before he was diagnosed with Arsenicosis. Due to the advanced condition of his disease, the local community-based organization (the same one which helped me gain access to my participants) lobbied to the Block Development Office, and a deep tubewell
was installed in front of his house around 12 years back. Even though he had changed his
drinking water, prior consumption had developed several chronic ailments. His skin lesions
developed into tumors and turned malignant. He has ulcers in his back on the spine, his foot,
forehead and his fingers. His family members were of the opinion that his pain was too much for
him to even understand whether the Ayurvedic medicine was doing any good to him. His sister-
in-law (brother’s wife) who lives in the same household mentioned,

“I don’t think his ulcers are getting any better. But he thinks his pains are better. I think it is mental relief for him because he has lost trust in the Western medicine. I have been married for 29 years and have been living in this, and I have seen him like this ever since.”

This female participant was more educated than many of her age, gender and religion in
rural Bengal. She was a junior high school graduate and even studied for senior high school
before she got married and had to discontinue studies. She perceived things that many others did
not. She elaborated that even if people know of the risk, they lack effective capacities to mitigate
the risk, as they cannot see how it is going to affect them in the long run (due to chronic effects
of Arsenic contamination), lack of financial abilities to mitigate, and lack of personal agency to
bring a difference in their own lives. Even when they see others being affected, they fail to see
the connection between how the actions of those being affected match with that of their own.

Chronic health conditions affect energy and stamina for work and decreases productivity.
Many of the diseases significantly decrease physical strength for engaging in strenuous jobs.
This has great implications on the rural agrarian communities where the main occupation and
livelihood is agriculture and farming. The majority of the farmers are subsistent farmers.
Traditional farming practices are labor intensive without much use of tractors. Sowing, reaping,
sorting, drying, and carrying the harvest to a storage house are all usually done by manual labor, without the use of much technology. These kinds of farming practices need extensive physical strength and stamina which Arsenicosis patients lack. These kinds of farming practices also meant that the farmers remain directly exposed to the sun for a long time every day. Those with skin lesions quickly develop irritation to the sunlight which makes it difficult for them to be exposed in the sun for long time. With long sun exposure, the skin lesions turn darker red and itchy, and also sometimes turn mucousy. Consequently, many people are forced to change their traditional livelihoods, and take up alternative livelihood, that hamper their prospect of success in those newly adopted ones, as elaborated by two participants earlier.

Those with Keratosis (crusty, scaly growth on outer layer of the skin) in their palms and feet often feel extreme irritation and itching in hands. Continued contact with water may turn the Keratosis into boils. There are many evidences of Keratosis boils turning malignant, and ultimately leading to amputation of limbs. Those engaged in farming are continually exposed to the Arsenic contaminated water and soil while farming which continues contamination and worsens the situation. One female participant mentioned,

“I spent all my life working in jute farming. I started when I was 11. I liked working in the field. Then I got married, I was 17. I continued to work in the farm with my husband and other family members in his family. My husband died, but I still had to work in the fields. Who will take care of us? Who will give us food? Then his (husband’s) brothers forcibly took our land and so my brother brought us here. I can’t work in jute fields any more, I don’t have all fingers. I don’t have strength in the body. So, I tried garland making\(^4\). But nobody wants to buy garlands

\(^4\) In Hindu society, almost every household has a small altar-styled temple and the idols of God are decorated with flower garlands every day. It is a common practice. This practice makes flower business and flower garland making
from me. They think I am dirty and my disease will spread if they touch my garlands. My palms always feel soggy, it never dries out. I keep it covered, but it still does not dry out. Doctor says I should amputate more fingers, but I don’t want to. I would better die.”

This lady in her late 50s has been living with her brother’s family after she was thrown out of her husband’s house as she could not work in the fields any more, and could not monetarily contribute monetarily into the household. Her husband died with Arsenicosis, and she has already lost three fingers to Arsenicosis. She has at least three more fingers seriously affected. She got Arsenic contamination from drinking contaminated water and also working in the jute fields in Arsenic contaminated soils. This is one of the reasons why she not only has melanosis (spotting in the body), but has keratosis in the palms and lower limbs that has turned mucousy and malignant.

In addition to the direct health impacts, the social and economic implications are far and wide and affected community and relational health. Like this participant, many others mentioned societal reactions to their diseases or deformities due to the diseases. There is a very commonly prevalent belief that the diseases are contagious. The same participant further elaborated,

“I had three nephews and nieces born in my family. But their parents don’t let them come near me. I feel as if I am untouchable. They don’t cook for me, and my room is separate from the main house. They probably hate me and laugh at me.”

During the fieldwork, this treatment of ostracization, untouchability, and inferiority towards the patients with skin lesions and Keratosis was evident in many households. Some households kept it subtle, but it was very evident and vivid in a few cases. It was hard to miss a common household business, especially by women. Garlands are made with bare hands by sowing flowers into a thread.
that the effects of ostracization were greater and social repercussions were much higher when women had clearly visible Melanosis or Keratosis than when such manifestations were in men. In one of the households, the wife spoke about her husband’s severe Keratosis:

“I know if I had that (severe Keratosis), I would not be living in this house any more. As a woman, don’t you think? I also know it is not contagious, then I would have had this disease much more than what I have now. But still, staying with someone whose whole body is like this, it feels awkward. But as a woman, I have no choice. There is a lot of family discord because of this. I know it’s personal but I’m still sharing, I don’t think I want to live with him.”

This participant was ashamed because of her inability to accept her husband irrespective of his physical conditions. But her comment clearly shows the kind of personal and relational discord that takes places in households due to a chronic disease. This participant continued,

“His skin is always so itchy. He feels hot all the time. Summer or winter, he would switch on the fan. It’s very difficult in the winter. I used to sleep in my daughter’s room. Now that she is married, I have to…(the participant started sobbing and could not finish her sentence.”

Another participant said:

“When I first saw my husband on wedding night, I thought I have been cursed by the snake God. His skin was like snake skin. He died in two years. I was scared of his skin.”

This 26year old female participant had an arranged marriage and had just seen her husband’s face before the wedding when he had come to ‘see’ her during matchmaking. This is a common cultural practice in arranged marriages. As mentioned before, Arsenicosis does not manifest in the face. The participant recalled, her prospective husband was then wearing a full sleeved shirt buttoned to the top. It was not possible for anyone to see if he had any skin lesions.
Her prospective husband was considered very suitable because he had his own house and a
tubewell. Incidentally, this was the same tubewell that was severely contaminated and had
caused her father-in-law’s and her husband’s disease. It was only on the wedding night that she
could see him clearly. She recoiled as she recalled:

“I cried the whole night. I was scared. I cried, oh snake God, please don’t kill me. I felt
dirty being touched. I wanted to run away. But that is not something you do. Then he became
very seriously ill and died two months before my son was born. I won’t lie, I was a little relieved.
I still vividly remember the first night.”

In the cultural context of India, especially in rural communities, divorce cases are almost
non-existent. Often, husbands leave their wives, or take up another wife, but wives do not have
the ‘social’ right to do that. Especially among the Muslim community (in which this participant
belonged), women have very limited rights of divorce and remarriage. This participant still lives
with her late husband’s mother and takes care of her. Her mother-in-law said,

“I feel bad that she was widowed even before she knew life. She has a child. She needs to
work to fend for us. But what do we do? We have no savings, we spent everything in his (her
son’s) and his father’s treatments.”

Many of the families that have had Arsenicosis-induced deaths in their families are
generally careful about how their younger and future generation consume water. But not all
families follow safe-water habits for themselves. Sometimes, they are unaware how their actions
might cause contamination in future generations. In many households, participants mentioned
that they do not even bathe their children in contaminated water, even if it means the adults have
to drink Arsenic water. One participant mentioned:
“When I was married, my husband, and my step-daughter had the disease. His first wife had died. My husband died in 2 years. I knew from the beginning I won’t let my son drink this water. I walked 5-6 miles every day for years to get good water. We got the good water tubewell only 6-7 years back when my son was almost in his teens.”

This female participant in her early 40s had a 7-years old grandson in her house. She does not even let him bathe in tubewell water. She learnt to ride bicycle so that she could raise awareness of the issue among others, especially female members of the neighborhood. Another participant from the same neighborhood shared a heart-wrenching story of loss and despair caused by Arsenicosis:

“This para (neighborhood) is called Bidhoba Para (widow’s neighborhood). You go to any house, you won’t find any old man. They all died from drinking water from that tap (pointing towards an old, dilapidated tubewell in the corner of the neighborhood). Nobody wants to get married here. We wouldn’t have been married if we knew.”

This female participant in her early 50’s cannot remember when her husband died. It has been so long. They feel bad and ashamed when they say anything negative about their marriage and husbands. But in impoverished rural areas, the bridegroom’s suitability for marriage depends on their ownership of a house, irrigable land, and a reliable source of water at home such as from a tubewell or borewell, and not on the health and wellbeing of the bridegroom himself. In societies where women’s roles are largely limited to managing the household, women’s choices and voices are continuously unheard even in matters that concern their own lives. One participant elaborated this issue further:

“Before my marriage, we knew my husband’s first wife had died in a disease. We did not
know what kind of disease that was. We had no idea about Arsenic. It wasn’t a thing in our village (referring to where she lived before her marriage, her father’s village). My husband was a school teacher, he was a respectable man and that’s what mattered to my father. We were four sisters. I was a little fat and dark-complexioned so everybody said that I would have difficulty in getting a suitable match, so I agreed for this marriage despite knowing that he was a widower and had a grown-up daughter. I was promised that I can continue studying, but when I came here, I had to take care of my step-daughter who was very unwell because of the disease, and soon my husband also became seriously ill. I cried to my father, but he said, this was my destiny. I had my son within a year and soon my husband died. Life has been very hard. I feel I haven’t smiled forever.”

In the villages with chronic Arsenic contamination, such stories are rampant. Apart from the skin lesions leading to Melanosis and Keratosis, there are many other invisible diseases that have long-term effects on the body. Neurological disorders affect both the peripheral and nervous systems, and cause several problems in the day-to-day lives of the patients and the families. It creates numbness and loss of sensation in limbs that impede normal day-to-day working, walking, eating or any strenuous job. It also causes feelings of extreme heat and coldness and takes longer time adjust to seasonal temperature changes.

These invisible problems also cause a lot of social challenges, especially if a lady is affected. One female participant who had drunk contaminated water since her childhood had only developed minor Melanosis when she got married at the age of 14. But the pressure of a married life, and childbirth had made her so weak that she lagged in all her household duties. She was sent back to her father’s house as she was deemed incapable of being a ‘good wife and
daughter-in-law’. Her father mentioned,

“I got my daughter married early to give her a better life. She had some white spots, but she was very pretty. But within 4-5 years, she was sent back by her husband. They said she always kept unwell and they cannot afford her treatment. We begged them, but they did not accept her back. She has two children and she must work to support them. Her life was ruined because of this disease.”

The daughter mentioned about the hardships of her daily life and difficulties of getting a job as a married lady who was not accepted by her husband.

“I work in a ladoo factory. I don’t get work every day because a lot of people, especially young girls work there. They prefer unmarried girls because they never take leaves. I had to take leaves when my younger son was unwell. Then they ask me why I don’t live with my husband. If I tell them about my disease, they might not call me for work at all. But since I can’t tell them that, they think I am a bad girl and that’s why my husband doesn’t take me. I tried to find other jobs, but it’s the same story everywhere.”

This story of hardship to find jobs and maintain jobs was heard from many participants. Even though women had more difficulties in finding jobs, men also faced challenges. One patient with ophthalmic conjunctival congestion mentioned:

“I used to work in construction sites. I was a supervisor and earned quite well. But due to my eyes, I can’t stay outside for a long time. So, I started working in a company for sewing ladies’ blouses. I sit in one place and just sew blouses. I earn much less. Also, I can’t keep sitting for long (because of neurological problems), so I need to take breaks. They have already asked

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5 a kind of very popular Indian dessert made with butter and chickpea flour, and rolled by hand to make into spheres, and available in locally grocery stores and sweetshops.
me to either be productive or quit. There are a lot of people to take my job.”

Difficulties with carrying out day-to-day operations or to be engaged with family profession was one of the primary economic costs of chronic contamination. One farmer who has developed Hyperglycemia with a glycemic index of 750 mentioned:

“I feel no energy in my body after 2 hours of working in the field. So, even though we were traditionally seasonal rice and jute farmers, I have changed to growing vegetables which is not as laborious, but also the money we get is much less. Once I had a cut in my feet while working in the fields, and it did not heal for a long time. When I went to the doctor, doctor said this is because of my high sugar and if I have something like this again, it might turn into bad and my feet might have to be amputated. Therefore, I wear slippers even on the fields which is very inconvenient. I also have to urinate many times a day. It’s so hard to work in the fields because of my health conditions.”

Social costs of chronic contamination are not confined to the health effects, decreased physical stamina, or social stigma and ostracization. There are many other social costs that are associated with early death of the male members of the family. Death of a male family member also means death of the primarily source of income in the household. In a male-dominated society, absence of a male family member also poses a threat to safety and well-being of the women in the household, especially the young ones. Several participants mentioned that they married off their daughters at a very early age because either the male members of the family died at premature age due to Arsenicosis-induced diseases, or due to failing health of the male member of the family. Women often come back to their father’s or brother’s houses in case of death of husbands. Households are almost invariably run by men, and women are not expected to
take up that role in their absence, and therefore the family disintegrates. Apart from disintegration of the household, this has significant repercussions on the ownership of irrigable land and collaborative farming by one large family. One participant, a young male farmer in his mid-20s, shared,

“When our father died, he was 42, and we were quite young. We had just started working in the family farm. Even though it wasn’t a big piece of land, we could grow rice in one side and jute on the other, and also few vegetables. Production was okay and we never had to buy food from outside (referring to the market). But when he died, my older brothers wanted to divide the land. When we did so, individual plots were not (big) enough for rice. The pond (needed for soaking jute fibers) was adjacent to the land one brother owned, so only he could farm jute. But he sold everything to a third party, and went to the city to work in a factory. The new owner started fish business in that pond and made the pond unusable for jute soaking. We also used to get money from letting other people use the pond for soaking jute. That stopped. We started cropping vegetables in our smaller pieces of lands. Our income decreased drastically. From well-off farmers, we became subsistent farmers.”

This tale of economic cost of the chronic contamination due to untimely death of male family members had a strong social element of loss of traditional livelihoods. In the traditional cultures like in Bengal, moving out from a traditional livelihood is not an easy option. Many social customs and hierarchies are attached with one’s traditional professions (and form the part of the age-old Caste system in India). Marital relations are made based on one’s traditional professions and roles in the society. Breaking out of these traditional professions upsets the social structure as a whole. This also builds discord in the society if a person or a family from
one traditional profession joins another profession. This increases competition in the new profession and need for tapping/capturing limited resources. Stories of loss of financial stability with the death of the male members of the family was frequently heard from participants.

Another female participant shared that her father-in-law, husband and an unmarried brother-in-law died within 3 years from each other. The youngest brother died first. Her father-in-law was already of failing health due to his Arsenicosis induced neurological problems. He could not bear the loss of his young child and had a heart attack within few months. Her husband died two years after her father-in-law. Her daughters were very young. So, she got them married very early. When asked if financial hardships were the only reasons, she shared,

“A lot of people have left this place in recent years because of the problem with water, and new people have come in. These new people are all Hindustani6. They engage in bad things (referring to anti-social behaviors and hooliganism). Girls were being kidnapped and they never came back. We heard that they went to work somewhere else, but they were little girls. They (referring to the new people) also pass lewd comments to young girls and do bad things (referring to sexual assault). Shortly after their (referring to her daughters) father died, one girl in our neighborhood was kidnapped and later left on the road. They did bad things to her (meaning sexual assault). She ultimately committed suicide. I wanted my daughters to study, but I was too worried. The oldest one was 14, and the youngest one was 10 when they were married. I know it’s wrong, but I couldn’t let them die. They were better off this way. I have also got three male members (referring to the sons-in-law) in my family again. They will protect us.”

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6 an umbrella term used for non-Bengali speaking and Hindi-speaking people of Northern India, mostly from the neighboring states of Bihar and Uttar Pradesh. They speak various dialects of Hindi. This term is of colloquial use and does not indicate any particular ethnic or linguistic group. However, Hindustani is a more formal term for the dialect of Hindi-Urdu that is spoken in Delhi and Western Uttar Pradesh.
In many households, after the demise of the male members, female members have made choices which are perhaps not socially and legally acceptable as the legal marriage age for women in India is 18. It is a punishable act to get married or marry off before that age. But in their individual circumstances, just like this participant, the choice was between bad and worse, and they chose what they considered better. Such stories of social losses proved that the chronic contamination had far-reaching impacts, not just on public health or economy. In another household, one male participant in his late 20s mentioned,

“I had to quit studies after my 8th grade because my father was diagnosed with heart disease and couldn’t work in the field any more. He only did small jobs. So, I decided I will put all efforts in my brother’s education. He was not very healthy, but a brilliant student. He was studying B.Com. (Bachelor of Commerce degree, an undergraduate degree program). But in his second year of college, he also developed some heart problem. Doctor said it maybe because he consumed Arsenic water since childhood. He finished his B.Com. exam and got a job in the city. but one day we got a call from the hospital. We spent all that we had. We had thought that he would change our future, but that did not happen. Rather our future changed. We spent all our savings in his education, and his treatment, but we could not save him.”

Even though the member of the family who died was not the primary or the only earning member of the family, and neither did he have wife or children, this story brings forth another perspective on how chronic contamination creates chronic social and economic losses. Even though these stories of social and economic costs are stories of individual people or households, they represent a bigger issue at the macro-level of the society. The contamination is crippling generations, it’s just that since the contamination and its health effects are not immediate, it is
not visible as of now and there are only speculations of its effects. This lack of foresightedness in tackling the situation in its budding stage indicate a systemic failure of the government. This however directly derives from the past and prevailing political structure of West Bengal and the nature of governance that have always been practiced in the state. The next section further elaborates on this point.

**Political History of West Bengal, and nature of governance**

The political history of West Bengal and the structure of governance has significant impact on the way contamination has spread, and the way mitigation initiatives have been adopted. West Bengal was under a democratically elected socialist/communist government for 37 years, and grew an image of a welfare state. In all these years, most of the essential services and basic amenities have been serviced by the government without taking extra service fees from the users, especially so in rural areas. In rural areas, unlike the urban areas, property taxes are low, and water is not separately taxed. This has not only been strenuous on the government exchequer but also people have grown a tendency to assume that it is government's task to provide basic amenities without people having to pay for it. Even the current political administration, in spite of being a non-socialist government, is not moving away from that welfare state image. Overall, this factor makes it difficult for people to accept that they must pay for accessing improved qualities of basic amenities, such as cleaner water and better healthcare. During the fieldwork, the overall tone of the villagers reflected this attitude. They had no idea how government gets money and what were the different ways they spend it. There was a general consensus among people that it is people’s right to get basic amenities free of cost, and that right comes from voting and electing the political representatives at the *Panchayat*, State and
Federal levels. This unique structural issue has grown into a cultural nature and severely cripples the choices people make concerning access to basic amenities. This also affects the collective and personal agency in risk perception and risk mitigation.

In line with the political mandates of the current and past ruling parties, political history of the region need special mention in understanding the issue of contamination. Since many of the villages where the field work was conducted were situated in the border areas of India and Bangladesh, a number of participants were refugees from Bangladesh. Many of them did not come from then East Pakistan right after the independence from British empire in 1947. A number of people also came during the independence movement of Bangladesh from Pakistan, in the 1960s and 1970s. Even though there were rehabilitation plans for those who came right after the partition, there were limited plans for those who came later. While the early refugees received refugee status, the later ones were frequently perceived as unwanted immigrants and infiltrators, and hostility rose against them. This attitude of hostility was more if they had no relatives already living in West Bengal. Many of them had left Bangladesh without any of their belongings and money, and had nothing in their possession. Therefore, they settled anywhere they found a place. In those days of crisis, followed immediately by the Naxal crisis (refers to the violent movement organized by communist-inclined students and intelligentsia in West Bengal in late 1960s that lasted till late 1970s. Naxal movement started in 1967 in Kolkata, from the Presidency College, an elite college from colonial times. Students organized to protest against the growing capitalist stand of the then Congress party government, for imposition of land ceiling act to legally redistribute land to landless laborers and organize factory workers for better working conditions. Soon the movement took a violent turn, and thousands of protesters were
killed. This ultimately toppled the Congress party government and brought democratically-elected communist party government in West Bengal which ruled for 37 years in the state) in West Bengal and change of political regime, people did not have many basic amenities including drinking water, toilets and transportation. They dug up dugwells and tubewells rampantly. Water quality was not checked due to dire need for water. One participant who came to live in one of the severely affected villages in 1969 recalled,

“A lot of things were going on those days. Those who were friends earlier, suddenly became enemies. I had little children. So, we decided to cross over the border and come here. We are from Barisal (One of the coastal provinces of Bangladesh, south of Dhaka province. Barisal is around 155 miles from this participant’s current village in West Bengal). We came by walking. It was a long walk before we crossed the border and came here. All these places were jungles. There were snakes, foxes and all sorts of animals. Ghoti (A colloquial term used to refer to people living in the Western side of undivided Bengal, now West Bengal) people did not like to live here. This was a poor man’s neighborhood. There was a tubewell made for the Bangals (a colloquial term used to refer to people living in the Eastern side of undivided Bengal, now Bangladesh. After partition, and till date the term is used for people whose ancestors once lived in the Eastern side of undivided Bengal) who came before us. We used that one, and pond water for bathing. In those days, who would check whether water was good. We drank whatever we got. I don’t know who is to blame.”

This 71-year old female participant had lost her husband and young son in Arsenicosis-induced cancer. She had also lost four of her fingers, and had a malignant tumor on her shoulder. Her only daughter was also affected. She developed serious gynecological problems and had
several miscarriages. She was only few years old when they came to India from Bangladesh. Even though she does not recall too much from her days in Bangladesh, she mentioned,

“One thing that I remember clearly is our house in Barisal. We had a joint family, and many uncles and aunts lived together. But while crossing the border, many of us went to south, some went further inside, and we stayed here. We are all disintegrated. I think I still miss some of my cousins. That was the heart-wrenching part about partition. But I am glad they did not come to this poisonous land.”

This emotion of loss of land, livelihood and people due to partition was echoed by many participants who came from across the border, so was the horror of lack of amenities after coming to India. They felt neglected and unwanted by the people of West Bengal, and many of them looked for places away from them and chose to live with those people who fled from across the border. This decision also meant they lived in poorly developed places with minimum infrastructure and lived without basic amenities. In times when basic amenities are scarce, people do not look for quality. This also happened to their use of water. Another participant mentioned:

“Our family wanted to be together. Parents, brothers, sisters, their wives and husbands, and some of their parents as well. We were a big family. We needed a big place to live. So, we came here and built this (referring to the house they lived in). This was a 20 katha (a traditional unit of land measurement used in India, Bangladesh and Nepal from colonial time. 1 katha=720 sq ft.) land where we all lived. We could not go anywhere else because of land prices. Younger brothers and sisters drank this bad water and fell sick, and died young. Sometimes I think we should have gone to the city even if we had to live separately. At least they would have lived. I sometimes blame myself as I insisted that we all live together.”
Another participant whose family came from Bangladesh recalled how his father always missed the house he grew up. His father came in 1985, ten years after the Farakka barrage was built. In the summer following start of the operation of Farakka Barrage, there was dry season in Bangladesh. After few years, there was a big flood at the end of the rainy season which flooded their houses as well and they had to leave. He shared,

“My father told me, after Farakka was built, there was no water in Ichamati (a major trans-boundary river which flows through India and Bangladesh and also forms the boundary between the two countries). There was no water anywhere. It is at that time, they had to dig up tubewells to get water for drinking and irrigation. Then there was a flood. Everything was lost. My father’s Muslim friends suggested that he comes here because we were Hindus. My father came here for work, and did not go back. I heard that the water he had in Desher Basa (Colloquially used to refer to Native land, by people who once came from Bangladesh, in Bengali) after the sukha (Dry Season or draught, in Bengali) was also bad. I think it started from there and continued here.”

Partition of India, independence movement in Bangladesh, growing tolerance against religious minorities in Bangladesh in 1950s-1980s caused major changes in demography of the Bengal Basin. This was further upset by construction of Farakka Barrage, and subsequent changes in water flow in the rivers of Bangladesh and West Bengal alike. These connections provide evidence to the intersectionality of the issue of Arsenic contamination from geophysical,

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7 Farakka Barrage is a barrage across the Ganges River, located in the Indian state of West Bengal, roughly 16.5 kilometres (10.3 mi) from the border with Bangladesh. It has been a topic of debate and discord between Bangladesh and India due to India withdrawing extra water causing water shortage, major siltation and regular seasonal flooding in southern Bangladesh. It has also affected flow of water in all tributaries and contributories of river Ganges in both West Bengal, and Bangladesh.
social, political and economic perspectives, and effects on different population groups.

In those times of change, the political scenario in the state, and in entire South Asia was extremely volatile. People from three major South Asians nations, India, Pakistan and Bangladesh, were constantly on move. Those were the days of war, loss, migration, and finding of new hope in midst of this mayhem. India went under political emergency between 1975 to 1977, and it was in 1977, the new socialist/communist government sworn in in West Bengal which started a new political regime based on socialism, populism, and welfare state image. The government was busy securing a firm hold in the state and largely discounted the scientists’ warnings about contamination. This attitude of government severely impeded risk mitigation efforts. The next section provides details about how the political climate of West Bengal in the last forty years has affected the issue of contamination and risk mitigation both at the level of collective agency of the government, and personal agency of the people.

**Political favoritism, apathy and corruption**

One of the reasons of delayed and insufficient infrastructure development is discounting of the risk by the government until very recently. After the issue was first discovered by a group of doctors and scientists, there were a lot of efforts from them to inform the government and initiate action. However, government has not been very proactive in dealing with the issue. Initially, the government at all levels refused to believe in the existence of the problem. Even though gradually they acknowledged the issue, the intensity of the problem was not acknowledged until very recently. Instead of proactively taking measures to address the issue, government increased the minimum acceptable limit of Arsenic in water. The current drinking water standard or Maximum Contaminant Level (MCL) set by the World Health Organization is
0.010 mg/L or parts per million (ppm). This is equivalent to 10 μg/L (micrograms per liter), whereas permissible limit of arsenic in India in absence of an alternative source is 0.05 mg/l (50 μg/l) which is 5 times of what is allowed by WHO (Indian Standards for Drinking Water, second revision of IS 10500, 2004).

Due to long-term impact and chronic nature of Arsenic poisoning, it was hard not only for the people, but also for anyone other than the scientists who were researching on these issues to understand the gravity of the situation. Water contamination has always been a big issue in the region. Therefore, initially government did not think of much about this issue. In the already impoverished state, government was trying to develop other infrastructure which they perceived of more immediate and crucial need, such as roads, transportation, education and health. It may be noted here the communist government came to power in the state in 1977, after 5 years of a violent and bloody revolution by the educated class of the state, toppling the powerful Congress party which was instrumental in bringing India’s independence. That was the time when people were in desperate need of hope, and the new government channelized all its energy to develop the infrastructure they thought was missing, so to gain popular favor. Before the communist government took over power, there were innumerable complaints of misuse of Land Ceilings Act by the powerful and big farmers/landlords. The Land Ceilings Act put a ceiling on how much irrigable land one person can own. The big landlords bought irrigable lands from subsistent farmers at cheap prices in family members’ names, and thus maintained large irrigable lands. The most important agenda that the communist government took up upon coming into power was to regularize the Land Ceilings Act, and redistribution of irrigable land to subsistent farmers as well. This measure had both positive and negative impacts. In the positive side, it meant that
the lands were properly distributed to all and subsistent farmers’ condition was initially uplifted. But it also meant that the lands were broken into small pieces which made commercial farming practices hard and ultimately lowering the total agricultural yield. This mandated that people continued labor-intensive farm practices which exposed them to contaminated water for continued period.

Another major political event that changed the political scene of West Bengal from mid-1960’s to early 1980’s was the freedom struggle of Bangladesh and subsequent independence. Bangladesh became an independent nation in 1971. As mentioned before, in 1960s through 1980s, there was a huge exodus of refugees to West Bengal to evade religious and linguistic persecution. Many of these people came and settled in formerly uninhabited places. It was both a political agenda and mandate to rehabilitate these people in the new country. Needless to say, this put extreme pressure on the resources of the state. Water was one of the most basic amenities that had to be created and provided to these people. As a result of which, from 1960s to 1980s, there was an unprecedented increase in the number of tubewells, without checking for water quality. At that time, actual access, availability and quantity of water was an immediate need and a bigger concern for the government than quality of water. In the 1960s, there was high pollution with surface water, and groundwater was considered clean. Therefore, there was increasing attempt to dig up tubewells to provide access to groundwater, especially in rural areas.

Lack of fairness in installing the water access points in the communities have been a long-standing issue. Ruling parties have been accused of political favoritism and nepotism in sanctioning and installing water access points in neighborhoods resided by the Panchayat members, and supporters of the ruling party or the local elected political representative known as
the Member of Local Assembly (MLA, representing an area in the state assembly), or the
Member of Parliament (MP, representing an area in the federal parliament). There is no
transparent process in application and sanctioning of the water access points. Even though the
Block Development Office is responsible for monitoring an area and sanctioning water access
points, the finances for local area development largely comes from the MLA’s (Member of Local
Assembly), or MP’s (Member of Parliament) Local Area Development Fund (MLA LAD/MP
LAD). Therefore, the influences of the MLAs and MPs in how that money would be spent are
paramount.

This political connection between the finances of the basic amenities has high potential
for corruption. During the field work, a number of participants brought the issue of corruption,
favoritism and nepotism in sanctioning and installing water points. One participant mentioned:

“*There are multiple patients in my family. My parents and older brother died because of
Arsenic. My sister and brother-in-law also had the disease. I requested for a tubewell near my
house. I did not ask because only I needed it, but the whole neighborhood needed it. We are
Congress (Indian National Congress, a political party, the primary opposition party during the
communist regime) supporters and everybody knows that. So, when the previous government
(Communist Government) was here, they did not sanction a tubewell. Then the new government
(Trinamool Congress) promised us that they will install a tubewell. But then the tubewell was
installed in the next para* (neighborhood or locality) in front of the house of someone who is
their party supporter (referring to Trinamool Congress). But they have no patients in their

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*literally means neighborhood, but geographically more proximate than neighborhood, and has a
strong community feeling among the residents. Often the *Paras* are homogenous with residents
being only from the same religion, caste and professions."
That same respondent’s brother-in-law (sister’s husband) brought out:

“The people from the old government (Communist party) once burnt our field. We thought it will change when the new government comes. But nothing has changed. They (Trinamool Congress) don’t care about anything but getting votes. Even the roads are bad here because not many of their supporters live in this side (of the village).”

This sentiment was echoed by many other respondents in other villages as well who believed that the installation of the common water points was politically motivated as the political parties gained political mileage and support from people by doing special favors to them. Many villagers considered to change their political preferences just to get better access to water, and did so. But they still thought it would be difficult to get favors from the ruling parties. One male participant in his late 60s cited an example:

“Before CPM (Communist party) came to power, we supported Congress (Congress party). But then we started voting for CPM so that we get some favors that their supporters got. But then the government changed again, and now everybody knows us as CPM. Even if we change our party again, I don’t think we would get anything.”

India is considered as the largest democracy in the world. All political representatives are directly elected by the people, from the Panchayat member responsible for village development, till the Prime Minister of the country. However, during the field work it was found that choosing the political representatives is the only democratic right the people in the rural areas truly have. They have no power of negotiating their rights of basic infrastructure like water and health, and must depend on the political representatives or the bureaucrats. There was no simple and
transparent process in application, sanction and installation of the water points. This frequently leads to corruption and favoritism.

Corruption was identified in the process involving actual installation of the tubewells as well. The installation of the tubewells is done by private contractors who is engaged by the Block Development Office. The designated place is tested for clean water and a suitable depth is determined to get Arsenic and other contaminant/pollutant free safe water. This initial testing of the spot and sanctioning the tubewells is done by the Block Development Office with the help of the Public Health Engineering Department, and Public Works Department. A private contractor is then given contract to dig up and install the tubewells of a pre-determined depth. Contractors receive a flat rate for installing each tubewell. After the installation, any engineer or the representative of Block Development seldom visit the tubewells. This lack of results-based and performance-oriented payment system and lack of monitoring of the work by the contracting party breeds corruption at the level of implementation. Depending on the depth, multiple 3.9–7.9 in long stainless steel or PVC tubes or pipes is bored into an underground aquifer. The lower end is fitted with a strainer that purifies the water. The upper end is fitted with a manual pump above the ground that lifts water through suction method. Cost differs in the material of the pipe used and also the number of pipes used under the ground. PVC pipes are not good for underground usage, but they are cheaper. Contractors cut cost in two ways: by using PVC pipes instead of stainless-steel pipes which are non-durable but cheaper, and by installing tubewells of lower than sanctioned depth, and thereby cutting cost in the number/length of pipes used. Additionally, when the tubewells are of lesser depth, the digging cost and associated manual labor cost also turns out less. A community social worker provided an example:
“Because of my interest, I learn from Sir (referring to his employer, an environmental chemistry professor) the number and types of tubes that should be used for deep tubewells. If the tubewell is supposed to be of 500 ft, it would need 6 or 7 pipes. But often the contractors don’t dig up to the designated depth. They, for example, dig up to 300 feet. This way they can save cost in two ways. They will pay less to the workers as they have to work for less hours, and will have to fit lesser number of pipes. Also, if they are given contract to install tubewells in every 500 meters for 10 kms, they will install one tubewell in 600-700 meters. This way, they cut the entire cost of two-three tubewells in that contract. The Block Development Office, the local MLA, Panchayat members all have their own share in the money the contractor saves. It is therefore profitable for all to be corrupt. The system is corrupted as a whole.”

Corruption affects the access to water and health in multiple different ways. If the designated depth of safe water is 500 meters, and the tubewell is 300 or 400 meters deep, it means the duration for which people will get clean water is reduced drastically. Also, testing of water for contaminant might start later than when it should be, leaving higher chance for health effects on people. Also, when PVC pipes are used to cut costs, it increases the chance for damage sooner. Also, if low quality stainless-steel pipes or iron pipes are used, it increases the chance for rusting which has adverse effect on the water quality. Corruption, as a whole, significantly impacts the way contamination continues and risk mitigation is impeded.

**Nature and Physical Qualities of Risk**

It is hard to miss the intersectionality in how Arsenic contamination is a social, political, historical and politically constructed issue. Even though risk perception maybe based on the
physical qualities of risk, especially due to Arsenic being an invisible contaminant, there were many instances where risk perception, attitude towards risk and mitigation behavior were socially constructed and had links to the social-cultural practices, as discussed in previous sections.

In case of Arsenic risk perception, physical qualities of Arsenic do pose great ambiguity in risk perception. Arsenic does not change the organoleptic or the sensory qualities of the water. Arsenic does not make the water look, taste or smell different. This quality makes it invisible. On the contrary, bacterial or algae contamination of surface water or presence of iron in groundwater change the organoleptic significantly. Presence of organic and inorganic matters in the water, such as fecal matter, algae, leaves, foam and froth make water appear dirty, changes opacity, tastes and smells different. Presence of iron in groundwater makes it taste heavier and bitter, smell pungent, and turn water containers of into reddish color when water is stored in them.

Bacterial and iron contamination have been prevalent and known in the region for a long time. Therefore, it becomes difficult for the communities to comprehend presence of a toxic metal if it does not change the sensory qualities of the water. This make Arsenic a non-issue, and bacterial and iron contamination a bigger issue.

Closely related to this issue of physical qualities of risk. People were found to have taste preferences for water. While they cannot say for sure whether water from a particular well has Arsenic or not, they can almost always say if there is Iron in water. Due to change in sensory qualities, they do not like to drink Iron-clad water, even if it might lead them to drink Arsenic-contaminated water. As a result, people often continue drinking Arsenic contaminated water but refuse to start drinking from a new tubewell if they find the taste of the new well is not per their
liking. One participant pointed out:

“I liked the water from our previous well. It tasted sweet and light. Then we heard the water had some poison. How can it have poison if it looked so clean? They installed a new tubewell, and the water is not good. It smells of medicine and I feel heavy when I drink it. All the bottles and containers are turning yellowish. I sometimes drink from the older well as it tastes better.”

Even though unaware, this participant was referring to Arsenic in water when mentioned poison, and the heavier water meant the newly installed well-water had presence of Iron and medicine to purify water from bacterial contaminants. Newly installed tubewells come with a special valve that releases water purifier into the water. This medicine tends to change the sensory qualities of the water which is often unacceptable to the people. As a result, people often continue drinking Arsenic contaminated water that furthers the susceptibility to contamination and impedes risk mitigation.

The long-term and chronic health impacts of Arsenic contamination, vis-à-vis immediate and acute health impacts of bacterial and iron contamination of water is another critical factor contributing risk discounting by the communities. Even though Arsenic is an extremely toxic metal, the health impacts are not immediate. Additionally, the scientists have not been able to discover how much consumption of/exposure to Arsenic contaminated water will cause what kind of health effects, and how soon the impacts will be seen. Health effects are also dependent on many internal and external factors related to the person who is being exposed to contaminated water, such as (1) lifestyle (for example: how active or sedentary the lifestyle is; what kind of occupation they are in, and whether it involves a lot of physical labor), (2) food habits (for
example: what kind of food they eat, such as number of times they eat local parboiled rice, whether they eat local leafy vegetables, frequency of eating beef), and (3) water consumption and exposure patterns (for example: how long they have been exposed to contaminated pattern, whether they only drink, only bathe, or do both; whether they are exposed to contaminated soil on a daily basis). Since Arsenic primarily enters through water in the body, it also exits easily with sweat. Someone with strenuous occupation and an active lifestyle will be able to offset the impact for a longer time. Consumption of nutritious food is another way to delay or stop the effect of the contamination on one’s body. One participant observed:

“I started getting skin pigmentation when I was in my late 20s. I was in a desk job and did not do much exercise. I felt tired and had low energy all the time. Then I heard from the doctor that I should eat more vegetables, run few miles a day and lead an active life. I followed this for a year and most of my pigmentation went away. I still follow the same lifestyle. I could not only stop getting more pigmentation, but have also been completely cured of the disease.”

It has also been perceived that people in the same family with similar water-consumption patterns, but different occupations also show different intensity of contamination. During the fieldwork, I met one such family with three brothers. The three brothers grew up and lived together till they were in their mid-20s, and consumed water from the same tubewell. Their father who was a school master died of Arsenic related cancer. The middle brother who was a post-master in a rural post-office and had the office in his home had the most signs of contamination. The youngest brother was a school teacher and had to bike to school 3 miles away. The oldest brother was a farmer. Even though the oldest brother has had maximum consumption of contaminated water due to his age, he had the least signs of contamination which
can be attributed to his strenuous occupation and a more active lifestyle. The middle brother said:

“When our father died, we didn’t know about Arsenic. Now we know the symptoms may be related to Arsenic. But our mother who also consumed contaminated water since her marriage had much less pigmentation and other chronic diseases. I think this is because she managed the family farmland while my father was a school teacher and didn’t work in a physically exhaustive job. My oldest brother also works in the field and has the least (pigmentation) among us all. We don’t know for sure, but this probably indicates the impact of lifestyle in chances and intensity of contamination in one’s body.”

While physical qualities of the risk had an impact on perception of risk, both physically and socially constructed risk had profound impact on the way people perceived and found personal agency in risk mitigation. Issues of persona agency had the most paramount impact on both risk perception and mitigation, and was a culmination point of all the factors that have been discussed so far in this chapter. The following section elaborates the issues of personal agency and its impact on both risk perception and risk mitigation.

Personal Agency

The way people perceive risk impact their personal risk mitigation behavior and personal agency. At the same time, perception of personal agency or lack of it thereof, opportunities to change behavior, and structural barriers in risk mitigation significantly impacted the way risk was perceived. A number of instances and responses provided interesting perspectives on people’s personal agency in maintaining a water-safe behavior. There were several cultural and structural reasons on why people often failed to or refuse to perceive risk, and adopt a water-safe behavior. Even though majority of the participants mentioned about lack of knowledge and lack
of opportunities to know about Arsenic in detail, and their inability to bring changes in behavior due to economic hardships; few others mentioned that they refuse to see the risk as they lack resources and effective capacities to mitigate risk. One participant elaborated this issue:

“I have heard so much about the Arsenic problem. Several people have died in our neighborhood. I see so many living with those marks in their body. But what do we do? If we don’t drink from this water, we won’t have water. The only pond in the neighborhood where we used to draw water from is now sold and used for growing fish. That pond was the reason why our family did not get those (referring to skin lesions). I don’t want to test water. I would prefer to be ignorant than knowing about it since I can’t do anything to change my situation.”

This 27-year old female participant provided a different take on perception of risk and personal agency. Her lack of perceived personal agency impacted her attitude to the perceived risk and mitigation behavior. This lack of personal agency was a result of structural deficiencies that prevented her from taking action against the risk that she perceived but refused to acknowledge. She was not alone with this helpless and hopeless mindset.

There was yet another section of people who greatly discounted risk and refused to act. Their behavior can be equaled to that of Ostrich syndrome, i.e. avoiding to see an impending risk in the hope that the risk will automatically pass. One participant was so defensive that she refused to talk to me at first when her neighbor requested her to speak to me. Even though she did not speak to me in detail, she almost taunted me when she said:

“There's no point asking us about anything. We will be like this no matter what. People come and go, but nothing changes. We were born here because of destiny. We could be born in the city like you, and you could be born here and suffer. It’s all destiny. I have accepted it.”
Even though this 41-year old female participant’s son died at the age of nine and her husband was seriously sick, she refused to accept any kind of intervention. Her extreme defensiveness was less of a lack of personal agency but more of a silent protest against the structural deficiencies in provision of water services and public health support by the authorities. Her neighbors said that she was vocal and proactive till few years earlier, and worked towards bringing the deep tubewell to the neighborhood, but she has grown hostile recently due to the corruption involved in the political systems.

There was yet another section of large number of people who knew about Arsenic contamination and had been suffering from its effects, but still did not take any action due to lack of self-motivation. In a household where three people have already died due to Arsenicosis, and two are currently extremely unwell, the younger generation lacked effective plans to stop contamination from happening to the future generation. For example, a young adult of just 21 years who had plans to marry in 2-3 years was asked about his plans for ensuring safe water for his future wife and children. He said:

“what can I do about it? the nearest water point is far. We have to get water from here.”

(refering to the 500-feet deep tubewell installed in front of his house few years back)

Then I was asked, “then who would do it?”

He answered, “government should do it.”

I asked, “why should government do it?”

He answered, “because we cast votes for them.”

I asked, “how would the government know that you have an issue here? They installed a 500-feet tubewell, don’t you think their job is done? And which government? You voted for one
government, and they changed. So, whose responsibility is it?”

In the answer to my last question, the young man was evidently upset, and answered, “I don’t even know where to take the water sample for testing.”

As a matter of reference, this household had two new motorcycles and three bicycles, three mobile phones and one landline phone. Their house was big and there was a new construction going on in one side of the house for planned marriage of one of the young adults in the household. They had huge pieces of irrigable land which was leased out to other farmers for farming, and they received rent and a part of the yield from the land. The nearest water source other than the one in front of their hour was less than a mile away. Overall, this household’s income was more than the average household income of majority of the villagers who were visited, and had better structural opportunities to mitigate risk. Yet, they lack the personal agency and motivation to bring change into their own lives, and depended on the political system without realizing that such an attitude marginalized them even further.

This lack of priority to procure and drink clean water at the cost of sacrificing some other luxuries in life was seen in many other households. Clean water was not in the priority of most people who perceived it as a responsibility government should fulfil, and they have no stake in it. Another very well-off household was visited where water is drawn from the household shallow tubewell which presently has only tertiary level of Arsenic, but the neighboring areas were showing increasing rates of contamination. The government water tester had asked the household to stop using the tubewell, but the household still uses it. When asked why they can’t change the tubewell and install a deeper one, the head of the household said,

“We don’t have the money. It costs 35000-38000 Indian rupees (US$550-600) to install a
deeper tubewell. we can’t spend that much.”

As we were talking, I saw the older son of the household leaving with his new bride in a brand-new scooter which cost around $625 in the market price. Noticing that I was looking at the scooter, the father of the new groom proudly said that this was gifted as a wedding gift (or dowry) from the bride’s family during the wedding, so were many other things such as a new fridge to keep vegetables to offer to God, and a microwave. People’s perception about water quality issues was overshadowed by their need and demands for other ‘brighter’ things in life, which had an immediate and tangible need and benefit. On the contrary, investing on Arsenic purified better water source is structurally more difficult, and the benefits are both temporally and spatially distant, an investment that did not look lucrative to the people.

In some cases, those who supported the current political party, perceived the lack of action from the government as a sign that they had no risk from Arsenic. This especially happened with people living in villages which are in the neighborhoods of Arsenic contaminated villages, but no death had yet happened in their own villages or neighborhoods. One participant who I met on the road insisted on speaking to me on this issue:

“I know about the villages and neighborhoods where these are happening. But I think this is being taken out of proportion. This can’t be so serious. Then Didi (Referring to the current chief minister of West Bengal, Ms Mamata Banerjee, fondly called Didi, meaning sister) would have done something about it. We voted for her and brought her to power and I trust her judgment. The government will not let us down. I’m not saying it’s not happening, but it’s not serious. You’re wasting your (referring to me) time.”

This participant, a young adult male of 19 grew up at a time when the previous
Communist government was losing control and the current ruling party was gaining strength. He was not the only one who had their trust firmed up on the political parties and the democratic governance. This trust in the political parties and democratic governance did not seem well-informed, but more emotion-driven. His comments show how some of the people only looked at their own personal contexts of loss and despair before judging the gravity of the situation. Even though non-contagious, Arsenicosis is a public health issue due to its chronic nature and potential of harm.

Along with the structural challenges impeding personal agency, many cultural practices coincided with practice of unsafe-water behavior and risk mitigation. Villagers followed many cultural norms that mandate certain behaviors which were hard to change. One such practice which was found existing among female participants, irrespective of their religion, is the practice of taking bath at dawn and before preparing meal for the family. In places with timed water connections, this posed a potential problem as they had to bathe using the contaminated water. In a household with several Arsenicosis patients, but without any death, the oldest female member mentioned:

“I have to take bath early in the morning, before sunrise. This is what I have been doing since I was an adolescent. I have to worship, and cook breakfast. My husband and my sons go out at 8 am in the morning. I cannot enter the kitchen in Basi Jama. I have to make them tea and some food to eat before they can go out. The timed water supply does not start before 9. If I have to wait for it, my husband and sons will have to go out without eating anything.”

This example again shows the priorities people have that has direct contradiction with

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9 Clothes that are worn at night, during sleeping. It is considered impure. It is a cultural norm to not enter kitchen, touch stored drinking water, or touch the altar wearing that clothes.
safe-water behavior. Even though this participant was highly concerned about water quality, this practice was not something she was willing to adjust or change, rather she believed this practice is not something that can be compromised with. At the same time, she mandated that her daughters-in-law do not follow this. So, she asked them to not bathe in contaminated water, even though it meant that she had to do all the morning chores of the household by herself.

There were also instances of positive personal agency which villagers performed within the similar social, cultural and informational resources that other people had. One such case was of an illiterate Muslim male brick-kiln worker in his mid-40s whose father died of Arsenicosis and his mother was severely affected. He never married and was taking care of two of his nephews whose parents also died because of Arsenicosis. He was also taking care of two other nephews and nieces whose father had multiple ailments because of Arsenicosis. This was something unheard of in his community and the social-cultural environment he lived in. He elaborated on his choices in life:

“We are from a poor family. My father had seven children. Two of them died very young in malnutrition. We did not have a house and always lived in rented shanty houses. We could not even afford to go to school. What could I possibly give to my wife and children if I had one? I did consider marrying, but then my older brother passed away when his sons were very young and my sister-in-law became estranged. I thought if I could be a father without marrying. They call me Baba (A common term for father, used in most of South Asia and many Arab countries. Also, often used for unrelated older people). I could not afford to feed more mouths.”

He further added,

“My younger brother married and had three children. But he is always so unwell, and
can’t take care of his children. I am paying for the girls. I want them to study well. I would not get them married till they want. My mother sometimes wants me to get married, but I say I do not want to spoil someone’s life by marrying her into a poor family of 6 people. I heard from my boss at work that I am doing a noble thing. I don’t know about that, but I am happy.”

His testimony proved that education alone does not make one wise, but wisdom comes from learning from experiences, which as this participant pointed out, gave him his life path. During the interview, it was very evident that he was not only happy with this decision, but very proud as well and offered to share his story with anyone that might be in his condition. From his experience of his own family, he has learnt the need for family planning and population control which he thinks can mitigate many problems that exist in West Bengal, and India in general. His and other people’s suggestions will be discussed further in the next chapter.

Another such example of practicing personal agency in safe-water behavior and mitigating risk came from a female participant who was widowed within 2 years of her marriage. Almost the entire family from her husband’s side died due to Arsenicosis. As a young bride, she had to drink that water too. But as soon as she realized the reason of the ailments her husband’s family had and the limited solutions that existed (fetching clean water), she walked 5-6 miles every day, in every season, to fetch clean water. At the same time, she continued to voice the concerns of the people in the neighborhood and in the Panchayat. She organized rallies and took other people from the neighborhood to the Panchayat Office and Block Office to lobby for clean water. Due to her personal actions, the neighborhood ultimately got two deep tubewells installed in the neighborhood. She reflected:

“This is our place. we have to work to make it better. I do not blame the government.
How would government know about each and every neighborhood? It is the job of the panchayat member. But I think it’s ultimately the people who need something, would need to demand for it. Unless we demand it, nobody would know how much we need it.”

She further added,

“I was ridiculed by the women of the neighborhood. I would leave my son with my sister and go to different offices to ask for clean water. They said, it’s not a woman’s job, you can’t do it and all those things. Well, there were not many men left in our neighborhood, so many of them died of Arsenic. I had to do something for the remaining of us. When they got it (the tubewell), some of them thanked me. They call me Masterni Bou (Masterni- female form for master, Bou- daughter-in-law or a married lady, in Bengali. Colloquially used to refer to a strong-willed and/or strict lady. In this context, a strong-willed lady. Also, her husband was a school teacher, commonly called MasterMoshai in colloquial Bengali.)”

Personal actions of this participant show the power of personal agency and self-belief. At the same time, it brings forward another crucial point of importance- negotiation with the political regime and the democratic governance. These two factors create power relations between the communities and government, and continually marginalize them by perpetuating the locus of power with the governments. Cultural roles of people in the society go hand in hand and exacerbate this. This participant, in spite of having challenges around the roles and rules of her gender took personal action to ensure the safety of herself, her family and the neighborhood as well. Fighting with the system that has ignored the issue for a long time, thereby marginalizing people with ailing health, and perpetuating lack of personal agency needs personal agency. Another such example of personal action was shared by a female participant in her mid-80s,
whose young daughter died at the age of 31, two days before installation of 2 deep tubewells in
her neighborhood that she lobbied for. She shared,

“My daughter had skin lesions. She also developed ulcers (Keratosis) in her toes. She
never got married because of that. But nothing stopped her. She kept on fighting to bring
tubewells in our neighborhood. She wrote letters to the government agencies who at that time
refused to acknowledge the problem. She personally went and visited them several times. During
rains, her toe ulcers got infected badly and she could not go to Kolkata. Then she would call
them from the pay phone booth in the village. Her health deteriorated but she said she was doing
this for the children of her school (her daughter ran a school from home for the children of
domestic servants). Due to her continuous lobbying, we finally got the tubewells. She could not
see the tubewells installed, but I am sure she is happy in heaven that her efforts bore fruit and
her children are safe.”

Her story reflected not only the struggle, but also the power of personal agency and
personal actions. She mentioned that there was lack of communication from the government
about the issue. She has heard that even the scientists and doctors who came to first test the
symptoms of the diseases they had were also threatened. Her daughter worked at length to make
people aware of the issue. They took neighborhood people to the church and organized events to
inform them about the issue. Since church property was not government property, government
could not object to it. She further added:

“People cannot be blamed. They don’t know. Government does not want them to know. If
people know, they will demand things. Government thinks they won’t understand and panic. But
I think they have the right to know. If you (referring to me) can do anything, make people aware
of its (Arsenic contamination’s) real menace. They will organize and do the rest.”

Her comments bring forth a crucial issue to the front, the lack of communication efforts, communicative challenges of the issue of Arsenic contamination, and ethics in communicating about a risk with considerable uncertainty. The next section describes and elaborates the communicative challenges.

The communicative challenges

The communicative challenges stemmed from all the factors discussed so far in this chapter: lack of government efforts to inform, educate, and communicate to public; and structural and cultural impediments in the actual communication. In many villages, the only source of the information about Arsenic was the community social worker employed by a civil society organization who often visited villages to collect water samples and informed them about the results of the water testing. Villages were also visited by representatives from the Block Development Office who collected water samples and took them for tasting. However, they never came back to inform about the test results. As evidenced from the statement of the young villager who had unquavering trust with the political regime, there are many people who simply assumed that there was no problem in the water and continued drinking. Villagers are neither given any reports of the water test results, not verbally communicated about the results.

Community-based common tubewells were also tested occasionally. Depending on the water testing results, the spouts of the tubewells were painted in different colors, such as red paint to indicate water was not safe for drinking, and green paint to indicate water was safe for drinking. Other than this visual communication, there was no organized communication efforts to inform and educate people of the need to drink safe-water, the health impacts of drinking contaminated
water, different ways Arsenic contamination may happen and how to prevent it. A 72-year old male participant said:

“Nobody has spoken to us about this problem. They (govt officials) think we won’t understand anything. They sometimes test water from our tubewell, but never informs us of the results. How do we know? We requested that one of us go to the office (Block Development Office), but they did not agree.”

Another participant, a 65-year-old male elaborated this point a little further:

“When one of the boys in our para has all these spots on his chest, and we took him to the doctor, then we knew he had Arsenic. He died eventually, he was only 24 years when he died. Then some of us went to the panchayat member and he (panchayat member) informed the panchayat head. They tested the water from the only tubewell we had in our para. After that, there was nothing. When we went to the office, they asked us to not drink from that tubewell. But we did not know where else we should go. We continued drinking that water till the piped water came. By that time, many of us were seriously affected.”

The village-based development depended on the efficiency of the Panchayat member of the village. In few villages, panchayat member arranged for water testing and people were told about water test results. However, they were not specifically told how they can purify contaminated water at the household levels. In the rural areas where water-borne diseases are quite common due to bacterial contamination, drinking boiled water is the most common and easiest solution villagers take up. So, instinctively when people hear about contamination in water, they use the same method. But, this method is not only wrong for Arsenic-contaminated water, it increases the Arsenic toxicity in the water. Arsenic is a toxic metal, so boiling does not
evaporate the metal, rather makes it more concentrated. Lack of communication about the nature, traits and consequences of the contamination further complicate perception and mitigation of risk.

In few villages, people were given small 3-Kolshi SONO purifiers to purify Arsenic. The purifiers were given to people under an international research project. However, people were not trained on how to maintain the purifiers, change filters, and when and where to dispose the purifiers. This led to three consequences: either people did not use them at all, used them wrong and did not change the filters on time, or disposed them off without proper precaution. This resulted in Arsenic again being released in the soil and contaminating it further. One of the participants who were given a water purifier under this scheme mentioned:

“I was given this kolshi water purifiers. But I did not know how to use it. Those people came, spoke to us, took blood and all. They saw that we had the spots. We got the purifier. I wasn’t sure if they would want it back. I did not want to cause a damage in it, so I never used it.”

Another participant who received a purifier mentioned:

“I used the purifier for 2-3 months. The water did not look any different but taste was bad. When I kept it in this container (pointing and referring to white aluminum container), this turned yellow and orange. So, I stopped using it. It must be just lying there somewhere in the house.”

The lack of communication and training on the use of the filters nullifies the usability of the filters. If people do not change filter on time, or dispose off the used filters in the backyard, this may cause Arsenic contamination in more concentrated form.

A number of cultural factors that impede exposure to different channels of
communication were brought out by the participants. When asked about their access to any news media, one participant reflected:

“We don’t have TV or radio. It is against our religion. It is haram (an Arabic word used to refer to any act that is forbidden or proscribed by Islamic law, and is one of five Islamic commandments that define the morality of human action). If we need to know anything, we ask Panchayat member or Maulavi sahib (Islamic religious clerics). They will tell us if we need to know anything.”

This male participant in his 70s belonged to Muslim community and did not have a television, radio or computer in his home. Three young members of his family had mobile phones, but they did not have permission to use the internet in their phones. They had one landline phone for the entire household which housed more than 20 people. This household was not unique in following the religious proscription against media technology, many other households of the same religious community voiced same concerns over access to western-styled media.

Newspaper reading was not a common practice for majority of the participants, it was especially low among women. Many participants lacked even the basic literacy skills and could not sign. Many households did not own a television set or a radio, but majority of the households had at least one mobile phone. Even in communities or households without this religious proscription, use of television for watching news programs was not common. People did not watch news or any other information-based channels on television. People only watched soap operas or sitcoms. Their responses reflected the boredom, stress and monotony of their everyday life. When asked about TV watching habits, one participants mentioned,
“At the end of the day when we sit to watch TV, we want entertainment. Children sometimes watch cartoons, and we watch Bangla serials (daily soap dramas). At that time, we don’t want to know sad and real things. We like the serials because they present what we want to be, but can’t be.”

Male members seldom watch TV. One participant said:

“TV is not for men. TV is for ladies and children. Occasionally, we watch cricket. Sometimes there is devotional songs or discussions that we watch. We don’t get time to watch it every day. In the evening if we have time, we will go to the club (local men’s organization and a place for cultural exchanges. People often play board games or other sports, and meet friends), or just sit in chai er dokan (local tea shop, often a place for friendly exchanges). There are people who go to work in the cities and work in offices. We chat and hear about their experiences.”

Like this participant, life in the village was so busy that most people that they mentioned that they never get time for watching TV. Men often gather under a tree in the evening, chat with other villagers and sometimes play cards. In their discussions, water issues are not a common topic. They discuss only if someone is chronically or terminally ill. There was hardly any discussion about collective action for Arsenic contamination risk mitigation and/or personal action. They had other issues that they considered more important and pressing than the water quality issues, such as health, road, transportation, electricity, crops and harvest.

Discussion with the experts (doctors, scientists, public health workers), and risk managers (elected political representatives and bureaucrats) brought out experts’ and risk managers’ perspectives on their communicative challenges. The doctors and scientists perceive need for
enhanced communication between the experts, bureaucrats and communities. They brought out that unless people are well-aware of the health risks of Arsenic consumption in their own personal context, there is a tendency to discount and perceive delay in the effects. One of the doctors, who had visited many villages to test gynecological impacts of Arsenic contamination on women of reproductive age, said

“It will be very effective to generate public awareness about the seriousness of the issue and how it affects them in the long run. Knowing about it generally is different from knowing it in their own context. It would be wrong to think they won’t understand. Obviously, they won’t understand unless they are told. Everybody knows about their own pain and has the right to know why and how it happened, and what is in store in future.”

One scientist shared a story of his experience with a mother and how his directed style of communication informed and the way the mother used water,

“One early morning I was taking a walk in the village. I saw a mother was feeding water to her baby, should be few months old, directly from the tubewell. Then she went on to do worship of the Sun which is a common practice in the village. I immediately knew she was religious so she needs a language that speaks to her. But I needed some authority to do that. Why would she listen to someone she does not know or does not connect with? I never wear my poite10. I went back where I was staying, gathered some white thread and immediately made a poite. I went back to her and posed as a priest, and told her to not give the tubewell water directly to the baby. She was initially apprehensive to hear me, and asked a lot of questions, but

10 Bengali term for the white sacred thread (original Sanskrit: Yajnopavita) upper caste Hindus, especially Brahmin men wear around their neck and chest as a mark of coming-of-age and taking up a Guru. Having a poite gives them the right and privilege to practice as priests.
she felt a sense of authority in me because of my Brahmin identity, not because I was a scientist. I hid that identity of mine so it does not interfere with the authority of a Brahmin which spoke to her more easily. Unless people are communicated in their own language, change is difficult to bring. Many would have to sacrifice themselves to bring this consciousness.”

The experts perceived that the political parties and those in the democratic governance enjoyed more authority than the experts. Therefore, since the political parties remained aloof about the issue, people did not consider there was a risk. This perception of the experts conformed to what other participants spoke about their trust on the government. The experts repeated that even when government does take mitigation measures, those are clandestine efforts. The direct style of communication and mitigation are largely missing in the government communication plans. In the limited government plans to inform people, there is no educational component in it. In few places where there is a communication plan, at least to visually demarcate the highly contaminated tubewells, there is no effort to directly communicate with communities to inform and educate about the risk of using contaminated water, or benefit of using the alternative water from a distant place. They also identified that even though women primarily fetch water, store them, purify them and use for various household activities, women have lesser opportunities to learn about the water quality issues than men do. One of the strongest social networks for information is Panchayat member in a village, or in case of Muslim communities the mosque- neither of these channels are open to women. There are still very less number of women panchayat members, and women are not allowed to visit the mosques for prayers. In this case, the only option that remains for the women to be brought to the fold of mass information, education and communication of water quality issues that can be explored
would be the public health workers or the ASHA workers who have an extensive network in the villages and have strong social relations with the women in the villages. ASHA workers are village based female public health workers who provide door-to-door information and service for basic primary public health issues such as maternal and child health, family planning, malaria and mosquito-borne disease prevention and personal hygiene. In the focus group discussion that was conducted with 19 ASHA workers and 3 of their supervisors during the field work brought out the opportunities ASHA workers have in helping out with the public information and education about water quality issues. One ASHA worker mentioned,

“My village have water quality issues. Not so much from Arsenic, but from bacteria and iron. Water tastes very bad. So, I told our doctor (Referring to the doctor at the community health center who is her supervisor) during our monthly meeting and he gave me some books on how to identify water-borne diseases and how to tell people about water quality issues. People would have acidity, diarrhea all the time. They would pop pills, but would do nothing to know what caused them and how to get rid of them more permanently. Then I took it on me and told them in detail on how to clean bacteria from water. There is definitely less of those problems in my village now. I think with our vast network, we can easily include this additional piece of telling people about Arsenic and its ill-effects.”

This was echoed by all the ASHA workers and their supervisors during the focus group that their network truly had the capacity to reach out to a lot of people in the villages and if properly trained, they can take up this additional responsibility. The ASHA workers joked, Amader kache bariri khabor na, hariri khabor o thake (we not only know about their house, but everything about what’s cooking in it). In the absence of opportunities to freely mingle with
other women in the neighborhood or communities, women often spill their heart to these ASHA workers. This creates a social bonding between these two groups of people which can easily be leveraged to inform about pressing health issues, perceived the ASHA workers. Another ASHA worker recalled:

“After my husband passed away, I decided to start working as an ASHA. Many people from my community (the participant was Muslim) raised their eyebrows and said that I’m doing haram by going out of the house and earning. I did not have a choice, so I kept quiet. But last year, one of the girls in my neighborhood almost had a miscarriage. I contacted the van (referring to the transportation available to transport critical maternal cases) and brought her to the big hospital. She did not have a miscarriage because of me. Now they are accepting of me and respect me, and find my job a noble job. There are even other people who want to take up this job. Village ladies really need help, and we can provide that help.”

The scope of the ASHA’s job in communicating about the water quality issues and generating action can be a real turning point in risk mitigation of Arsenic contamination. The focus group with the ASHA workers shed light on that. The ASHA workers, the doctors and the scientists, along with many community members made many suggestions that can change the risk perception of people and improve personal and collection agency towards risk mitigation. However, the scope of this chapter was limited to providing descriptive accounts of what the participants shared about their perception of Arsenic contamination risk, personal mitigation behaviors, challenges, self-efficacy and lack of it, and communicative challenges. These were divided in loosely developed themes and categories which were found to be intertwined and interrelated. The next chapter will provide more critical analysis of how the participatory
research methods empowered participants, and created a discursive space for them to share those stories. The next chapter will also critically identify how the participants’ discourses represent the structural, cultural and agentic challenges in mitigating the contamination risk. This will pave the way for providing some suggestions for a culture-centered approach in risk mitigation.
CHAPTER 5 | DISCUSSIONS

The previous chapter presented a descriptive account of the responses from the interviews and focus groups from the field research, and analysis of the secondary research on water infrastructure, and public health infrastructure. The chapter was primarily divided into themes and subthemes that emerged out of the data from the field research. The scope of the chapter was limited to providing descriptive accounts of what the participants shared about their perceptions of contamination risk, and challenges in risk mitigation.

The present chapter is a critical analytic extension of the previous chapter. This chapter critically analyses the findings from the field research using the themes of culture-centered approach. This chapter identifies how the participants’ deeply engrained mental models about risk and personal agency represent the structural, and cultural challenges, and its implications in perception and mitigation of the risk from contamination. It also provides critical analysis of how the participatory research methods of Community-based Participatory research approach empowered participants, and created a discursive space for them to share their stories. This chapter also critically analyzes additional themes such as researcher’s positionality, and the research methods, and their impact on how and what responses were received.

The present research was founded on the fundamental theoretical understanding that risk is socially constructed, and risk perception and mitigation is hindered by structural and cultural factors that impede effective capacities of communities to both perceive and mitigate risk. Therefore, it was crucial to understand the social and cultural factors behind risk perception. At the same time, power differences and inherent inequalities created by the same structural and cultural factors impede the risk managers to understand the challenges faced by the communities.
Risk managers have an inherent belief that lay people in the village communities will not understand about risks; therefore, no efforts of communicating and informing them about the risks will be effective. Such an attitude creates a vicious cycle of ignorance and lack of awareness among the communities, which is detrimental for both the communities and the risk managers. As detailed in the previous chapter, this research reaffirmed that the factors that impact risk perception, attitude towards perceived risks, and personal mitigation behaviors are deep-rooted: the structural, historical, political, social-cultural and economic factors directly impact the personal agency of community members, and collective agency of the risk managers. At the same time, these contributing factors were not only interdependent and symbiotic, but intertwined. Therefore, it was difficult to parse them out separately from each other. Several factors have had overlapping effects on the others.

The present research combined the theoretical and methodological principles of Culture-Centered Approach, mental models approach, and community-based participatory approach, and aimed at identifying how the deeply held mental models about risk could be effectively elicited using participatory methods, and how those mental models corresponded to challenges of structure, culture and agency. In the context of the present research, these three themes would frequently be identified as having overlapping effects on each other. Each of these factors also served as both cause and effect to other themes. By giving opportunities to all stakeholders to speak out about their understanding of the issue, participatory methods also attempted to break those mental models and develop new discourses. Culture-centered Approach puts heavy emphasis on the context in which the subaltern voices are subdued and power relations get authenticated. The current research reaffirms the importance of understanding the contexts in
which Arsenic contamination occurred in the region, people’s perception of the risk, power, inequality, and personal agency in mitigation of risk, and government’s incapacity to mitigate the issue. The historical, political and social contexts of the overall governance in the state, plus the government’s action on risk mitigation, water infrastructure, and traditional farming practices further impacted the perception or non-perception of risk, attitude towards perceived risk and personal risk mitigation behaviors.

Like the findings chapter, this chapter is also divided in several themes. While the findings chapter described what mental models existed of the risk, and personal agency in mitigation, this chapter critically evaluates those themes and situates them in the larger socio-cultural milieu of the region, to answer the questions of how those mental models came to be, and how they impact the risk perception and personal agency of mitigation behavior. This chapter not only critiques the existing power structures and those in the upper echelons of the power structure, but also the actions of those who live in the margins and who may inadvertently perpetuate this power structure.

**Power, politics and economic means**

Government action and power relations between government, the scientific/medical community, and common people is often perceived as the perpetrator of subduing of subaltern voices. While this may be largely true in most cases of political apathy in providing infrastructure, the present research shows that the state government in West Bengal was not only the perpetrator and controller of power, but also the victim of ignorance about the true nature of the contamination, and powerlessness due to lack of economic means.

Factors contributing to government’s lack of action in mitigating the contamination risk
can be interpreted in multiple ways. The government could not take enough actions towards mitigation due to their own inherent incapacity. The political history of the Bengal region in the era after independence and especially in the 1970s, forms a major context in the whole issue of groundwater contamination, government inaction and incapacity for mitigation. Many major political events occurred in 1970s: India fought a major war on both the eastern and western sides of the country, not for its own defense, but to aid Bangladesh in its freedom struggle. The war left a big blow in the national exchequer. Due to this, India went through a period of economic and political crisis in 1970s, and national emergency was declared in 1975 due to rising political turmoil. In early the 1970s, being disoriented by the ruling political regime, a fierce nationalist movement started in West Bengal called the Naxal movement that led to change in the ruling political party in West Bengal. This bloody movement brought the communist party in power. In the neighborhood, a new country took birth, when East Pakistan gained independence from West Pakistan in 1971 and Bangladesh was born. Bangladesh’ independence was significant for India not only for its military, but during the entire time of the freedom struggle, and also in the aftermath of Bangladesh’s independence, a major exodus of people took place from Bangladesh to India, primarily Hindus, but also many Muslims who wanted to flee violence. Also, in the aftermath of Bangladesh’ independence, India and Bangladesh signed a major bilateral treaty in 1975 on sharing of water of Ganges, the main source of surface water in the entire Bengal region.

The political party in the state government changed in 1977 in West Bengal. The new government, the Communist party was socialist in ideology and brought new mandates of equality in the state. Also, it is worth noting that the Communist Party of West Bengal had a
long-standing ideological and political rivalry with the ruling political party in the federal
government, the Indian National Congress. This political rivalry not only caused a lot of violent
clashes between the federal and state governments, but also meant the state was favored less by
the federal government, and received less funding than the other states. Immediately after
coming to power, the Communist Party of West Bengal mandated strict imposition of the Land
Ceiling Act of 1962. The enforcement of the Land Ceiling Act redistributed agricultural lands
into small and subsistence farmers. Lands were further broken into smaller segments. It also
meant that all segments of the land did not have access to ponds or canals for irrigation. Land
sizes remained smaller, yield was limited and farmers could not use mechanized farming
technologies.

Most parts of Eastern India did not practice cooperative farming until the 1990s. Political
economists attribute absence of cooperative farming to long-standing feudal system in India
which had caused an inherent mistrust between farming communities (Mandal, 1959; Das, Palai,
Das, 2006). This lack of trust can also be attributed to caste and religious divides- two
cultural factors that were continuously fueled by the royal families, landlords, and British empire
alike for most time periods of medieval and colonial time. Lack of cooperative farming also
meant that access to surface water was limited to only people whose land was next to the source
of surface water, such as ponds, rivers or canals. Along with seasonal dependence on rainwater
for irrigation, this further increased dependence on groundwater for irrigation, ultimately leading
to overdrawing of water. Scientists have agreed that the naturally occurring organic Arsenic
always existed in the Bengal region. However, the water tables in which the Arsenic existed had
not been tapped into. Overdrawing of water from the groundwater aquifers released the Arsenic
into water, and that initiated the process of Arsenic contamination of groundwater.

West Bengal has always been an agrarian state, and always had high population density. The main crop of the state is rice which is largely locally consumed. Lack of industry and lack of other exports have always kept the region impoverished. Change in the ruling party in the state did not change the situation. The political ideology of socialism maintained by the Communist Party led to frequent industrial strikes, and negatively impacted the industries. Many industries closed. The most impacted was the jute industry, the only major commercial crop in West Bengal. Due to the failing conditions of industry, more and more people joined agricultural workforce which increased the pressure on land and groundwater in rural areas. This led to increased competition among landless agriculture labors, disguised unemployment, low yield per farmer-worker and low wage, ultimately increasing marginalization. This lack of purchasing power also meant that the property prices in the villages did not go up, and conditions of the villages could not be improved including the infrastructure for water, and a vicious cycle of poverty continued.

These references of historical contexts were frequently brought in by the participants during the interviews. It was evident that the community members considered these historical and political events responsible for their continued marginalized positions in the society. However, a multiplicity in their interpretation can also be perceived. Those who came from Bangladesh settled in any location they could find. While some had the money to buy farmland of their own, there were a significant number of people who became farm labor in other people’s lands. Sometimes, they also agreed to work at cheaper rate than those who already were employed. The older residents saw the newcomers as unwarranted guests who were capturing
what they thought was rightfully theirs. This caused a dialectical relationship with the population who were already living in West Bengal. The landowning farmers and landlords took advantage of this situation and often lowered the daily wage rates which lowered the purchasing power and further marginalized people.

The party politics of the villages bring in a different dialectic perspective. India has a multi-party system and these political parties have strong presence in the villages, especially through the elected representatives of the Panchayat system, the lowest political-administrative units based in the villages. Panchayat is also responsible for developing basic facilities in the villages, including water infrastructure. Political interference in infrastructure development leads to a myriad of issues: bureaucracy and red tapes in sanctioning water points, and actual installation delays the whole process. It often leads to financial corruption where the political leaders take monetary favor from villagers for providing funds for infrastructure, despite it being their duty. Even more importantly, Bengal’s politics has always had an inherent nature of favoring party supporters even if it means that those in greater need of those services are wrongfully deprived (in this case, need for cleaner water). This political favoritism is a direct derivative of centuries old feudal practice which exists in the modern time only in different shape and format. This feudal mentality of politically powerful people greatly hinders the growth and wellbeing of the villages, and continue the marginalization.

**Emerging challenges in water infrastructure development**

Despite government corruption, nepotism/favoritism and politicization of infrastructure development, it will be wrong to think that government inaction was only due to apathy towards the issue. Beginning in the 1950s, all state governments in India, including West Bengal faced
multiple challenges in providing access to cleaner water in the villages. On one hand, there were issues with access, availability, and quantity of water; and on the other hand, there were issues with quality. At that time, in terms of urgency and priority, actual provision of water was considered more urgent than ensuring water quality. At the same time, lack of economic means created a significant barrier for the government in providing the desired water infrastructure. Access, availability and quantity issues are much more tangible and requirements are more immediate than water quality issues, not only for the government, but also for common villagers.

Along with this, during Bangladesh’s independence movement between 1950s and 1970s, the steady exodus of people from East Pakistan (present Bangladesh) to West Bengal significantly dictated the way water infrastructure could be developed. This mass immigration started at a time when the country was still recuperating from the aftermath of colonization, partition, two major wars in 1965 with Pakistan and China, and economic depression. During that time, government had a mandate of providing rehabilitation of the immigrants in the state. However, there were only limited places where rehabilitation plans could be made, and the number of people coming from across the border was much more than who could be rehabilitated. This exodus did not only include Hindus but also Muslims, who feared deportation, so they never reported to the government offices and settled wherever they found place. For these new people, access and availability of water were much more important than water quality. Lack of access and availability of water was more real during that time. Water quality of surface water was perceptibly bad and was causing serious water-borne diseases. However, groundwater quality did not apparently and immediately pose any threat. Therefore, during that time, government concentrated more on providing actual access to water and persuading people to use
groundwater. Between the 1950s and 1970s, millions of groundwater tubewells were installed to provide access to water in the villages.

It was only in the 1970s that local doctors and scientists noticed the skin lesions and concluded it as an impact of consumption of contaminated groundwater, and urged the government to encourage people to stop using groundwater for drinking. However, at this point, the government did not trust the scientists, and was reluctant to follow them. Government inaction can be interpreted in multiple ways. Since the 1950s, all state governments had been encouraging people to use groundwater instead of surface water as groundwater was considered safer. Later, when the scientists found out that groundwater was contaminated and unsafe, the government did not want to reveal it to the public as they feared retaliation, and loss of support from the public. Doing so would have exposed the government’s decades-long campaigns for propagating groundwater use in a bad light and would have proved the government’s ignorance of the quality of groundwater. This political selfishness kept government silent and aloof of the issue. Additionally, if the government had recognized the gravity of the contamination situation, they would have had to take immediate measures to mitigate it by providing access to cleaner water. Immediate mitigation was a big challenge for the government at that time, due to impoverished economy, complexity of the issue, and vastness of the area in which mitigation needed to take place. This prevented the government to initially even acknowledge the issue. More than actual political apathy on the part of the government, these structural challenges that the government faced hindered government’s mitigation efforts.

The government’s negligence and inaction has proved to be a double-edged sword, both for the government and for the villagers in at-risk or potentially at-risk villages. Government
inaction significantly impacted risk perception and mitigation in the villagers. Even though the ruling Communist Party in 1970s-1990s was populist and socialist in ideology and had a declared agenda of social and infrastructure development, they did not have the means to take on such a big challenge of mitigating the contamination risk and building infrastructure to prevent further contamination. At the same time, being a populist and socialist party, the Communist party government enjoyed considerable support and trust of the villagers. Therefore, even when the villagers heard about contamination from non-governmental agencies and scientists/doctors, they did not trust the scientists and the researchers, and instead continued to support the government. This made the non-governmental agencies’ risk mitigation efforts largely futile. Scientists observed that even when people were told about the risk, they refused to believe in any information about the risk. People’s trust on the government was so strong that they believed that if such an issue existed, government would inform people and take due action. They also believed that since government did not take any action, there was nothing to fear. People’s trust in the government despite government inaction did not let them see the risk of water contamination even when the doctors and scientists were trying to inform them of the issue. At the same time, government itself considered the doctors and scientists anti-government, and thought they were recruited by the opposition parties to malign the government. At the same time, the villagers who did not support the ruling party, were more accepting of the information provided by the non-governmental agencies, and scientists/doctors. However, their trust in the alternative discourses was also seen as a handiwork of opposition and attempt to malign the government. As a result, the opposition party supporters were reprimanded—they were not provided proper infrastructure even when they qualified for it, their lands were burned down,
men and women were humiliated, and sometimes refused water from common water points.

The government faced other challenges to improving water infrastructure as well. In the 1980s when the problem initially surfaced, Arsenic contamination was perceived to be a local issue and did not feature in the national and international agenda of development in the region. At that time, there were other highly politicized issues which were taking precedence and international funding was available to work on those issues, such as family planning, improvement of primary healthcare infrastructure, installation of household toilets, better sewer systems in the villages, better roads, and better infrastructure for education. The government was not only mandated to improve infrastructure on these accounts, but needed fast, tangible, measurable outcomes of improvement and change. Both state and federal governments were accountable for the financial assistance they received from the international funding agencies, and therefore concentrated all efforts in the projects mandated by the funding agencies. The seemingly local nature of Arsenic contamination and absence in the national development agenda made it harder for the government to effectively address the issue.

The hierarchical structure of bureaucracy and government distributes power unevenly, and creates a power distance with those who are not part of these structures. Those who control power have often been criticized of intentionally marginalizing citizens who lack economic and political power, by ignoring to look at the issues from common people’s perspectives. Political power also controls the financial powers. The case of governments in West Bengal and their poor handling of the issue in the early years cannot immediately be interpreted as a case of willful ignorance by the government. Government itself was suffering from a cash-crunch, and different mandates of development by foreign agencies. In the interest of being populist, they lost sight of
an important issue, and concentrated on something else, such as enforcement of Land Ceiling act, and redistribution of lands.

Such an impression of government gradually changed in the late 1980s, and 1990s, when the populist policies of the communist party government made further blow at the state exchequer: frequent industrial strikes and owner-worker clashes led to closure of many industries in the state. Land distribution made the land sizes smaller, and agriculture yield also suffered. The urban intelligentsia and students, who were the two most influential groups to bring the community party to power were losing confidence in the party, and were questioning many of government’s policy. At this juncture, the government needed to and wanted to maintain their populist image, at least in front of the farming communities in the villages, many of whom were strong supporters of the party due to their enforcement of the land ceiling act and redistribution of the land to the subsistence farmers. The government feared retaliation and loss of support from people. It was their own fear of loss of power and credibility, and lack of farsightedness that led them to ignore the warnings scientists and doctors were giving them.

**Lack of Information, Communication and Education for risk mitigation**

These factors significantly impacted why government failed to act on time. Government inaction significantly impeded not only government action of mitigation, but also villager’s personal agency of perception of risk. This crucial lack of judgment by the government and time lapse in taking necessary action led to continued contamination. It may be noted that Arsenic contamination in West Bengal is a chronic issue, and both contamination and mitigation take long time to display effect.

Only in the second half of 1990s, government first started taking cognizance of the issue
and built infrastructure for better quality of water. Even after recognizing, the mitigation initiatives remained clandestine and were portrayed as measures to improve general water infrastructure, without mentioning of the contamination. For another decade or so, government did not openly acknowledge the existence of the contamination in water, and therefore no attempts were made to communicate to public about the adverse health effects of contamination, repercussions of using contaminated water, and importance of using the newly installed deeper tubewells. Therefore, even when improved infrastructure was available, people did not use them due to their ignorance of the issue. However, community’s ignorance was not for their own fault, but a systemic failure of the government to inform them of the issue. This creates another vicious cycle of knowledge deficit: government did not inform people as they considered people would not fully understand the cause and effects of contamination, and as a result would be panic-stricken, and may start using other sources of contaminated water, such as surface water. This vicious cycle of ignorance and government negligence continue due to lack of efforts by the government to systematically and strategically design communication efforts, and to involve community members in planning and disseminating information. This deficiency of basic information and communication to community seriously hinders their perception of risk and personal agency in risk mitigation. Lack of community involvement and consultation in need assessment and area reconnaissance also led to other issues: the tubewells were often installed in places with lesser demand and accessibility issues

Even though government installed the deeper tubewells, they assumed that people would automatically change their old water-drawing habits, immediately accept the tubewells, and start to use the newly installed tubewells. This thought of the government exemplifies Rational
Choice Theory: government presumed that the village communities will invariably make prudent and logical decisions about water, and would start using the new tubewells, even if they did not know why they were supposed to use them. However, that did not happen. Even when people did start using the newer tubewells, they did not do so out of rational choice, but to avoid long queues in already existing tubewells. For them, it was a matter of convenience. Those who found it convenient to fetch water from the new sources, they did so, while many others found it inconvenient to walk to a distant tubewell to fetch water than using the tubewells at their homes, or nearby locations. People also had a great preference for taste and smell of water. Very often, people did not switch to a different water point in anticipation and apprehension of change in taste of the water. This inconsistency in use of new tubewells happened primarily due to lack of motivation and incentive to use the new tubewells, as people were not aware why those new tubewells were installed, and how using those tubewells would improve their health and wellbeing. Therefore, despite government’s goodwill and available infrastructure, the risk of continued contamination persisted due to lack of communication between government and the common people, and community involvement in mitigation.

Government’s action, inaction and understanding, and underestimation of people’s knowledge, attitude and behavior regarding water and contamination risks suggest a dichotomy in their thoughts: in one hand, government thought that the village communities would not understand about the risks and its health effects, and even if they are told, they will be panicked. Therefore, government found no need to communicate to the people about contamination, and developed their own mitigation plans. However, when it came to actual use of tubewells, government considered that villagers will be wise enough to use the new tubewells, even if they
are not given any incentive. I did not speak to enough and relevant government representatives during my research to understand government’s justification in approaching the issue from two distinct perspectives, but apparently, government either thought people will accept the new tubewells for its exoticism of being new and shiny, or just because it opens new opportunities for them to fetch water. Government’s lack of knowledge about the habits and challenges of their own constituents ill-prepared them to handle the crisis, and their efforts of mitigation was not successful.

**Challenges of risk perception/mitigation: Physical qualities, personal agency**

The structural deficiencies faced by the government in providing contaminant-free water infrastructure, and the culture of populist governance significantly impacted risk mitigation and unintendedly continued further contamination. In addition, the physical qualities of the contaminant itself made it difficult for both the governments and villagers in the affected villages to take cognizance of the contamination and perceive risk. The perceptibly bad quality of surface water, and acute health hazards of surface water pollution was a bigger concern for the government and villagers. In comparison, the invisible bad quality of Arsenic and chronic nature of health effects did not pose any immediate threat, which made it significantly a less concern. Therefore, the water infrastructure development took place in the form of providing alternative to polluted surface water, and the only alternative was groundwater, irrespective of whether it was contamination-free.

Perception of risk was also significantly determined by perception of personal agency in risk mitigation. The present research found that risk perception is often determined by the opportunities of risk mitigation. Just like government, even when villagers were told about the
risk, they did not readily take cognizance if they did not feel they can do anything to mitigate the risk. This attitude towards perceived risk can be interpreted as fatalism. This sense of fatalism was complicated by people’s expectation of immediate relief from any signs of Arsenic-induced diseases when they started using Arsenic-free water. In the case of bacterial polluted water, once the consumption of polluted water is stopped, the recovery is fast and noticeable. However, in case of Arsenic contamination, the process of recovery is slow and long-term, and personal mitigation efforts of the individuals have to be consistent. This imperceptibility and chronic nature of contamination posed many challenges in mitigation and furthered people’s belief in the lack of their personal agency in mitigation and fatalism. People had different experiences with consumption of contaminated water and effects of contamination. Even when people used and consumed water from the same tubewell, the effects of contamination varied, due to the different ways contamination affects different people. Biomedical reasons of why contamination affects people differently were never explained to people, neither by the government representatives nor by the doctors or scientists. The same variability also existed in mitigation effects. When people did not receive immediate benefit from switching to a cleaner source of water, they lost trust and hope, and started believing that changing source of water would not mitigate the risk. Even when they asked the visiting doctors and scientists, they could not give any specific answer, as scientists have also not been able to ascertain the right factors of intensity and effects of Arsenic contamination on one’s body. This uncertainty and varying degrees of impact on different people, coupled with requirement of long term mitigation plan make risk mitigation a more difficult proposition than in case of other water-borne diseases from water pollution. This necessitates a long-term, community-based, culture-centered information, communication and
mitigation plan that government has not deliberated yet.

**Temporal and spatial discounting of risk**

This uncertainty, along with lack of proper communication to inform villagers in the affected or potentially at-risk villages created various structural challenges for the participants in perceiving and mitigating the risk. Even when they came to know of the risk, they had limited opportunities to understand the extent of the chronic health effects on them, and whether it was multigenerational. In the absence of any concrete understanding of what causes contamination, and its health effects, the villagers temporally and spatially discounted the risk, especially in potentially at-risk villages with no patients with significant physical signs of Arsenicosis. There was a tendency in a large number of villagers to think that their water-related habits are better than ‘others’, and due to their better habits, they have higher immunity against contamination, in comparison to ‘others’ who don’t know any better. Many people from villages where contamination has affected other people believed that if contamination had not affected them ‘yet’, then it would also not affect them in ‘future’. Such an attitude displays a different kind of fatalism, which comes into being from a sense of confidence, but equally detrimental and dangerous for risk perception and mitigation of contamination. Such an attitude is not only due to lack of knowledge, but also because of lack of certainty in the correlation between duration and intensity of exposure to contaminated water, and manifestation of Arsenicosis. This further complicated any positive efforts taken towards mitigating the risk. Again, this again shows the need for a long-term, community-based, culture-centered information, communication and mitigation plan.
Political culture of West Bengal

In the last decade (1990s) when the governments started developing water infrastructure, infrastructure development has been slow due to financial constraints. Along with this, during the 37-years long communist regime in the state, the government developed socialist political culture and an image of welfare economy. People did not pay for basic amenities including roads, and water. Property prices were also low in the rural areas. Government also provided heavy subsidies in many other basic amenities, such as healthcare and education. Along with this, government also provided subsidies in basic food, and higher subsidies for those with low income. Due to this welfare economy image and subsidies, the government frequently run into financial hardships which makes it harder to spend on issues that government and people are not completely convinced about, an example of that developing infrastructure for cleaner water. At the same time, due to the welfare image of the government and years of receiving free services, people in the rural areas have grown a mentality that receiving free services is a right, and not a privilege. Villagers have repeatedly refused to pay for any kind of extension of services. Even though the subsidies helped millions of people get food, education, healthcare and access to water, it was not done with careful planning. It is impossible to not notice that the real intention behind these subsidies was to gain and control popularity of the government. This populist nature of the governments is partly to be blamed for causing a ‘crippled’ mentality that leads to lack personal agency, and people start believing that unless government helps them with money, they cannot do anything. This attitude ultimately affects government’s endeavors to carry out future development activities, and hinder people’s own mitigation behavior, not only in water contamination risk mitigation, but in any behavior, that requires them to show personal agency.
Moreover, due to this populist, welfare economy model that government selfishly nurtured to retain power and control over people, government has never quite successfully developed payment plan for any of the water-related services, such as to pay for extension of water infrastructure or betterment of services that would ultimately benefit the villagers. Even when such payment plans were developed, however they failed miserably as people did not pay for the services and simply went back to using contaminated water. The cost-benefit analysis between payment for better services and using contaminated water, ill-informed by their lack of knowledge about health effects of consuming contaminated water, favored them to decide against payment. Some people continued to use the better services, without making any payment, citing reasons such as ‘incapacity to pay’, ‘government is rich so they should pay’, etc.

During the current research, villagers’ willingness to pay for extension of services were also inquired. It was interesting to observe that nobody mentioned they do not want to pay for better services, but considered their capacity to pay was so less that their payment would make no difference. They also feared that even if they pay, their payment will not be enough, government will not use it, and their money will go waste. Villagers showed reluctance in paying for common properties as they did not ‘trust’ the other users and feared that their money will be wasted. People considered that common properties have no ownership, therefore it is difficult to develop accountability. When the water points were installed in common properties and were open to be accessed by anyone, it was difficult to determine whether those were only used by those who paid for it. People had apprehension that even if the people from a certain neighborhood paid for the water, water might also be used by who had not paid, thus depleting water and damaging the pump. This reluctance in spending personal funds to improve common
infrastructure was further complicated by the lack of priorities for better water quality. Reluctance to pay was not only for common properties such as water infrastructure, but for any services that they did not see any immediate benefit from. During the field visits, it was repeatedly observed that many households had many facilities of a modern life, such as motorcycle, mobile phones, television, but did not want to spend personal funds to install a deep tubewell in the house, or help government to do that. People repeatedly maintained an argument that water is one of the basic amenities that government has always paid for, and should continue to do that. If they can’t do that and people suffer, it means that people are destined to suffer. Due to centuries-old government inaction and government-crafted deprivation, villagers seemed to have lost hope that their plight would ever be improved. This has also seriously damaged their personal agency of bringing about any social change, even for their own self.

**Trust and confidence with other villagers and government authorities**

Participants’ responses brought out interesting dichotomies in the relationship and trust between the villagers, and with the government. On one hand, the villagers believed that the government should provide the necessary infrastructure, on the other hand they lacked confidence that any improved infrastructure would ever be developed. Villagers also lacked confidence in the government to even entrust them with their money. The villagers never worked towards advocacy or lobbying with the government for better provisions of water. Interestingly, during the data collection for the current research, almost every villager I spoke with asked me if I could provide better water, install a tubewell close to their house, or I could ask the ‘authorities’ to do that for them. In every instance however, villagers could not perceive their own role or agency in bringing about change. There have been almost no organized efforts from
villagers to demand cleaner water from the authorities. Interestingly, even when some villagers try to lobby for change in the infrastructure, instead of encouraging them, they are often discouraged. People often showed a strange tendency of apathy towards change in status-quo positions, even if this apathy towards change might be fatally harmful for them and their future generations.

This strange dichotomy of trust in government’s authority, but lack of confidence in their ability can further be attributed to the historical context of the relationship between the authorities and common people in rural India. The feudal system that existed in India since 1000 CE until India’s independence from British in 1947 created a submissive mentality of the common villagers to those in power. The practice of bonded labor was concurrent with feudal system, and was an integral reason why the feudal system could thrive for centuries. Politics of divide and rule, supported by barriers created by castes and religions never let the villagers united in the true sense, and the villagers could never realize the power of unity and organization against the feudal lords. Even when they organized breaking those socially and politically created barriers, protests by rural peasants were brutally dominated and subdued. The colonial era only saw rise in domination of the rural peasants, when along with the feudal lords and their middlemen, the colonial masters also dominated the farmers. During the British colonial time, India was used to grow raw materials for the textile industry in Britain, and were forced to produce commercial crops instead of food crops. Repeated acts of cruelty against the farmers have led to loss of their self-confidence and personal agency.

Despite its abolition in the post-colonial India, the seeds of feudal mentality remained strong, both in the small and large land-owning farmers, bureaucracy, in the governance
structure, and in the village community in general. The communist party in West Bengal tried to
change this mentality. Through enforcement of Land Ceiling Act, they tried to completely
abolish the feudal system and made the peasants owners of their own lands. Even though land-
ownership changed, but the basic submissive mentality of the farmers did not change.
Government made no plans to educate people on how to protect their land rights. Many of the
new land-owning farmers did not have any knowledge and experience of agri-business and
marketing, nor were they trained on those. Therefore, despite being landowners, they could not
fully utilize their position. Also, the farmers still felt inferior and remained submissive to the
former feudal lords. Many of the feudal lords started money-lending business to provide loans
the new farmers. The farmers’ inability to pay off the loan made them lose their lands to the
feudal lords, and it started a new type of feudal system which did not remain confined only to
agriculture, but spread to the political system as well.

In the post-colonial time, situations did not change much for the rural population. The
surge of western-styled, top-down, expert-driven development efforts directly intervened and
provided ‘solutions’ to the existing problems, without actually developing people’s capacity to
address and mitigate those issues on their own. The development efforts solved problems that
they considered important and needed immediate attention, without ever consulting what
mattered to the people. Therefore, the power relations between the poor rural population, and
those in authoritative position remained similar to what it was in colonial and feudal time: full of
fear without reverence.

In a 2013 article, former judge of Supreme Court of India, Markandey Katju described
India’s existing political philosophy as a feudal democracy. Even though people cast their votes
and government is politically elected through fair democratic election process, those who come to power are poorly educated about governance and do not possess the vision of bringing progress, especially in the villages. The power given to the elected representatives by the constitution is so great that they exercise control over people. People’s support to them is often result of the same kind of fear they had for feudal lords, and colonial masters, that lacked trust, reverence or admiration. Similar dynamics of power and control also exist within the bureaucracy who, unlike the political representatives, are more educated, hold permanent offices and therefore have almost no fear of losing job, or getting reprimanded for bad performance. They consider the villagers unworthy of their attention. This exercise of power and control also brings opportunities of corruption. Both bureaucracy and elected representatives make use of their power to frequently engage into money laundering. These dynamics explain why people hesitate to trust government with their money, or approach them to demand any service: they fear them. They also fear that their demand for better services will either be controlled, or not paid any attention to, like they have been in the past under colonial rule. Their lack of belief in personal agency also emanates from this perceived hopelessness.

**Lack of buy-in and accountability**

When people do not pay for essential services, it has serious implications on how people use and care for those services. Even when villagers are provided better infrastructure, they do not care for the infrastructure well and infrastructure gradually deteriorates. Since people do not pay for the services they receive, they do not grow buy-in for those services. For example, in case of water infrastructure, water taps are often kept open even when nobody is drawing water and thus water is wasted. In case of any malfunction of the taps or tubewells, villagers do not
take personal initiative to do the repairs. Local goons also often vandalize common properties, but villagers do not stop them due to their lack of buy in. If they do not receive water from one of the cleaner sources, they simply fall back to using the contaminated water. This further raises possibilities of continued contamination. The issue of non-payment also has another implication. Due to lack of enough finances to support such extensive infrastructure, the quality of services remains poor. Government often procures cheap quality materials to build the infrastructure which deteriorates faster. Post-installation maintenance and upkeep becomes difficulty due to lack of funds. Both government and villagers show lack of accountability to each other, and to the provided services as well. Since villagers do not directly pay money for these water services, they do not carefully use the services. Likewise, government does not feel much accountability to diligently provide services to the villagers. Government also does not show accountability in communicating with villagers or follow transparency in their decision of why the tubewells are installed in the specific locations, which again elevate people’s lack of confidence in the government, especially if they are supporters of an opposing political party. Lack of communication also has implication in the actual handling of the infrastructure. People are not informed about how the tubewells should be used so that the tubewells remain functional for an optimal time, nor are they informed about the simple mechanisms of the working of the tubewells, or simple fixes in case of breakage. Therefore, they use it unscrupulously. There is also a tendency among people to think that even if they care for the common properties, ‘others’ will not care for them, and therefore there is no point in caring for them. The multifacetedness of the issues of buy-in, accountability, trust and fear necessitate a community-engaged communication model, to open a discursive space for everyone, and jointly develop mitigation
Lack of community engagement in infrastructure development

Lack of communication and consultation between government and villagers in decision-making about the locations of the water points has serious implications in the risk perception and mitigation. Government does not consult villagers to select the locations where the tubewells should be installed. Even though the tubewell installation locations are usually determined as per population of the neighborhoods; often other factors such as political favoritism, lobbying by the local elected representatives, and non-availability of safer water in certain locations, impact decisions regarding locations of the tubewells. Villagers’ decision to use certain tubewells over some others are determined by several personal, interpersonal and cultural factors. People often find taste of some tubewells better than others (partly, due to certain metals/minerals in the water), and grow taste for water drawn from one source, therefore refuse to stop drawing water from that source. Therefore, some tubewells are used more than others.

Family feuds and religion/caste differences play great role in villagers’ decision making about which tubewell they would use. Even though sometimes the elected representatives of the villages, the Panchayat chiefs are consulted before installing the tubewells, villagers or actual users are not consulted, neither by the government/bureaucracy, nor by the Panchayat chiefs. Consequently, in the absence of a clear understanding of people’s needs, very often some tubewells are used more than the others. This puts pressure on the heavily used tubewells and they dysfunction frequently. In case of timed water connections, this lack of consultation creates multiple difficulties for people. Often the water is provided at a time inconvenient to people, or they have cultural barriers in using already scarcely-available water. A Hindu female participant
in her 60s shared one such example. As a Hindu, she had to shower in the morning before entering the kitchen or cooking. She and many other women in the neighborhood had to shower early in the morning much before the scheduled time for distributing Arsenic-safe water through the piped connections. They all had to use water from a tubewell which has been marked unsafe, despite knowing the danger of using such water. Irrespective of the quality of water, they had to conform to the cultural norms and could not change it at their own will. Even though the men of the household who were never expected to follow these ritualistic behaviors, they never stopped women from following these rituals and supported these unsafe water behaviors by women. In fact, any kind of deviant cultural behavior invites criticism, both within the household, and also in the society. These cultural norms not only affect the belief in personal agency to bring about change, but this lack of personal agency and a fatalistic mentality can be perceived as a culture in itself in this region.

**Fatalism and lack of personal agency as a social and political culture**

The fatalistic mentality and lack of personal agency can be interpreted as consequences of the dominant religions (Hinduism and Islam) followed in the region, feudal system, colonialism, and post-independence ideologies of welfare economy and western-styled development. Both the religions mandate complete surrender to God, and follow Karma. It also creates fear that if followers do not follow the rituals properly, there might be spiritual reprimands for their actions. Gods are considered as ultimate saviors of those who surrender completely. These spiritual philosophies have made the villagers depend on ‘God’ for every little thing, and they lack personal agency of action. Due to the fear generated by the religions, anything wrong that happens to them is considered as consequences of their own wrongdoing.
and wrath of God, and accepted as fate that they cannot escape. For generations, people in the region have believed in this lack of personal agency and fatalism, which has also extended in their belief about contamination in the water.

**Power relations and inherent mistrust among stakeholders**

This power structure and distance between government and people have further implications. People always have the opinion that government has a lot of money and can do anything if they wish. Governments, both federal and state, on the other hand face innumerable challenges in the development of the country, including cash-deficits to carry out development work. However, people fail to understand the various challenges government faces in providing services and amenities to people. Government inaction is always considered to be due to lack of goodwill, corruption and favoritism towards those who support the ruling political parties.

Even though it is true that India still practices a form of feudal system, both in political and economic systems, it will be wrong to say that governments in India has not made any reforms at all. India is an impoverished agrarian economy which gained independence from colonial rule only 70 years back. In the post-colonial era, one of the primary focus was on increasing industries and develop infrastructure, which made India one of the fastest growing economies in the world. Both state and federal governments have also adopted multiple welfare measures that have been working effectively. However, the country still faces a lot of developmental issues that is typical of a post-colonial country, burdened with ambitious development agendas. Rising population posits great challenges in carrying out many of the development agenda, especially with access to natural resources, such as water.

Four groups of stakeholders can be identified who can make a difference in Arsenic
contamination issue, and they all share power in various contexts. Doctors and scientists have the power of knowledge and technical knowhow about mitigating the risk, but they do not have the finances to build water infrastructure nor the people's network to effectively communicate to them to adopt water-safe behavior. Secondly, political parties have extensive ground network and people’s trust on them, but lack the right knowledge and knowhow to effectively communicate to the villagers. Civil society had the social network and knowledge of how to communicate with people about their issues, but they lacked the knowledge and technical knowhow of mitigation, and also lacked financial capacity to build infrastructure required for mitigation. Last, but not the least, the villagers in the at-risk villages have the power to change their own behavior, but they lack the knowledge on what change in behavior is needed and how their behavior would make a difference; and also, the structural opportunities to actually change behavior and adopt a new behavior. Despite their individual positions of power, all the stakeholders blame each other. The stakeholders’ mutual lack of trust and confidence on each other and lack of personal agency in bringing about change hinder the process of change, and maintains a status quo in the situation. It is true that local government is impoverished, but at the same time, both the previous government and the current government have been extremely skeptical of the scientists, doctors and civil society who they perceived as bourgeois and as threats to their regime. This same can be said about the doctors, scientists and civil society as well who always perceived government as power-hungry, but neither did they try to understand the financial or administrative challenges government had, nor they offered to work collaboratively to mitigate the issue. Villagers had a dichotomous relation of trust and confidence with the government, civil society and scientists/doctors. As discussed previously, villagers
lacked belief in personal agency in bringing change, and considered that government should do everything for them. They trusted doctors/scientists and civil society as intellectuals and knowledgeable people, but were still skeptical of their motive. Interestingly, they even doubted my motive of interviewing them and repeatedly asked what I would ‘gain’ from my research. It was not due to their lack of higher education, but an inherent mistrust in those who hold any kind of power over them, be it administrative, economic or power of knowledge. This inherent mistrust, skepticism and lack of confidence between the stakeholders prevented them to work together, to strategize and execute a sustainable risk communication and mitigation plan.

**Scope and opportunities of participatory methods**

In this context, the present research was found to be timely and opportune. This research manifested an urgent necessity for an engaged, community-based approach in risk communication, to build capacities of all stakeholders to identify and understand the risks, challenges each stakeholder group faces in planning and executing a workable mitigation strategy, and develop personal agency to mitigate. Such an approach may increase community buy-in and support in mitigation interventions.

The research method adopted for the research was particularly suited for data collection. The community-based participatory approach necessitated that I visited all the villages and did the entire data collection myself. The interviews were scheduled at least a day or two prior to the interviews. I personally visited the interviewees to schedule the interview and told them about the study and need for the interview. Their permission was sought before the interviews. On the day of the interview, the interviewee was read aloud about the intent and purpose of the study verbatim from the research study consent form, and they signed/gave thumb impression. This
process of permission-seeking was particularly appreciated by the participants, and they felt empowered that their opinion mattered. It also helped break the stereotypical mental model they had about the ‘educated classes’, who, the villagers think, do not consider the villagers worthy of their attention. During the interviews, the interviewees were given complete freedom to talk about everything that came to their mind related to Arsenic contamination, even if they were apparently not directly connected to the issue of contamination. This open-endedness of the data collection further developed people’s confidence in the research, and they were willing to share their stories of loss, despair and everyday challenges. During one of the interview sessions, a friend of the interviewee was present, and said, “government just does not want to help us. They have so much money”. In response to this, we spent close to an hour discussing how government functions and current financial situation of the both state and the federal governments in India, their challenges in providing more infrastructure, and how the villagers can make difference in their own lives with their small actions. After the discussion, the person who was a farmer his late 70s told me, “I wish someone had told me all these when I was young. I would have also contributed my part.” That was a moment of empowerment not only for the interviewee, but also for me as a researcher. This example also contradicted the dominant discourses that poor, ‘less-educated’ villagers essentially lack knowledge, understanding and desire to learn about their issues and they only want ready solutions brought to them. This example shows that when provided information in an open, dialogic manner without exerting power, the same villagers are not only more accepting of that information, but also can realize their own responsibility in effecting social change. This is particularly important in case of risk mitigation of chronic and temporally distant risks. Inability to see a risk that might happen in future raises uncertainty
about the risk. Therefore, it is important that the at-risk population is not just given information about the risk, but is also provided with in-depth understanding of the risk situation and its direct impact on them through dialogic approaches, between administrators, risk managers, knowledge experts, such as doctors and scientists, and the at-risk villagers. Such as approach is significantly more effective than a persuasive campaign, as the later just asks people to change behavior, without clearly telling them why they should change behavior. Dialogic approaches, adopted in this research provided the information to people in their context, and as it impacted them, and tried to bridge the temporal and spatial gap between the risk and the at-risk population. Such approaches help the experts understand common misconceptions the villagers have about the risk and risk mitigation, and plan mitigation with the villagers; and villagers understand the administrative, fiscal and structural challenges risk managers face in mitigation. Participatory and dialogic methods may help bridge the power distance between those in different hierarchies of power, and ease the tension that develops because of the power relations.

One community member accompanied me throughout the duration of data collection. He also helped me in finalizing the research protocol. The presence of the community member was not merely a formality, he was an active participant in the research process and assumed a role of community expert. His presence made the villagers feel that they had a representation in the research process. This helped in gaining access to the at-risk villages and at-risk population. Most importantly, involvement of the community member ensured that I understood the local political, historical and socio-cultural contexts in which the villagers were responding. Presence of the community member was highly significant not only for gaining access, but also in getting the kind of responses I received. Due to the presence of the community member, people
developed confidence in me that I was already validated by one of their own people, and I understood them. They felt much more comfortable in sharing their stories with me, and confidence that their stories would not be interpreted out of context.

The open-ended questionnaire adopted from mental model research had significant impact on the participants’ willingness to share their stories. During data collection, respondents were encouraged to share everything they could think of with respect to Arsenic contamination. This freedom of expression gave them confidence, both in the research process and on the researcher. Participants shared stories that would otherwise not be shared within a strict questionnaire. They also shared stories that were not apparently connected with Arsenic contamination. However, the connection they themselves could see between their stories and Arsenic contamination brought out some far-fetched impacts of the contamination in people’s lives that would otherwise be unknown. The social science research methods in itself were something the villagers did not have much familiarity with beforehand. They had never actually met a social scientist before me, and their interaction about the Arsenic contamination problems had always been with either natural scientists or doctors. In many instances, their natural reaction when asked permission to participate in the research was that I was a doctor, they would have to show their skin lesions or skin ulcers, and get some medicine. Some of the interviewees and their family members thought they were not ‘qualified’ enough to be an interviewee, did not have education, lacked proper language skills, or enough understanding of the issue. They only agreed for the interview when they were assured that there was no prerequisite educational qualification to be interviewed, and they should share what they know or feel about the issue of contamination. The social science research methods of open-ended interviews were unknown to
them. However, evidently, they were very much capable of taking charge of their own actions. Repeatedly, the present research proved that the dialogic and discursive research methods are capable of empowering subaltern people, magnify the traditionally unheard voices, bring out multiple alternative discourses otherwise thought to be unrelated, and thus ‘mainstream’ the alternative discourses of marginalized people.

**Researcher’s positionality**

My own positionality also significantly impacted the research outcomes, and provides significant learning for future participatory research and mitigation plans. Villagers perceived me both as an outsider and as an insider. Even though I belonged to the same community and lived in the region for a long time, my upper caste Hindu background, urban upbringing and educational qualifications initially distanced me from the villagers. My background was quite contrary to theirs and I was perceived to be belonging to the privileged class who they have only known to be exerting control over them, and they considered would never understand their plight. However, at the same time, I was the first researcher ever who went to them and wanted to listen to their stories in their own contexts and in their own locations. Before me, no other researcher had shown interest to learn their stories, without being specifically told what to do, or what to tell. The dialogic research method that I adopted for this research gave me access to the participants’ stories, as the participants had seen and felt it. The participants’ keen interest in sharing their stories also indicated that many of them had a lot of insights to share and were experts in themselves, but they never found an opportunity to share it with anyone. My high familiarity with the local language, and understanding of even subtle cultural contexts helped them share stories that would have been difficult to understand without understanding the
linguistic and cultural contexts. All these factors built their confidence in me, and I was gradually perceived as an insider. Most importantly, my positionality as a woman provided me great advantage in accessing women. No other female researcher before me had gone to do research on the topic in the villages. Therefore, women in those areas had never gotten an opportunity to share their stories, fears and challenges of risk perception and risk mitigation. This research created that opportunity for the women of the villages.

The scope of the current research was not to initiate any action-oriented change towards risk communication, and mitigation. The current research was aimed at rupturing the dominant discourses of risk perception, communication, mitigation planning and mitigation behavior, and create a platform for all stakeholders to let their voices heard. This research reached out to each of the four groups of stakeholders involved in this issue: the government and bureaucracy, experts such as scientists, doctors and health workers, civil society organizations, and the villagers; and listened to their respective challenges and scope of action in risk communication and mitigation to bring about an effective change. This research was also aimed at understanding the intersectionality of the contamination issue from multiple factors and contexts, to get a holistic picture, to plan a holistic solution. This endeavor to understand the intersectionality helped break the dominant discourse of risk communication and risk mitigation, and opened multiple windows to understand the length, breadth and depth of the issue and the challenges each stakeholder faces. It opened a space for all the stakeholders to deliberate, comprehend and voice their opinions and insights of the issues they have been facing for more than three decades. The research broke the long-standing belief among the villagers that only government has solution to all their hardships, and brought forth the challenges government faces in providing those solutions. It opened
alternative dialogue about government’s incapacity to provide every resource that people need, and explored villagers’ own personal agency and capacity for positive action.

Despite not being an action oriented research, the discussions with the various stakeholder groups highlighted some action-oriented suggestions that can help bring about positive changes in risk perception, and mitigation behaviors. The next chapter will provide those suggestions that emerged from the discussions, and discuss a culture-centered, community-based, communication strategy, and collaborative water management plan, to mitigate the Arsenic contamination risk in West Bengal.
CHAPTER 6 | SUGGESTIONS AND CONCLUSION

Even though the Culture-centered (CCA), Community-based Participatory research (CBPR) and Mental models approaches all aim for bringing about action-oriented, tangible, measurable change in the issue of concern, the scope of this current research was aimed at the first step in a long process. Thus, one potential contribution of this research may have been to catalyze the process of initiating symbolic change by rupturing the dominant discourses around risk perception, communication, mitigation, and amplifying the alternative discourses from all stakeholders. Change in the discourses brings new possibilities and opportunities for planning bigger change that can be based on the real data from the stakeholders involved in the issue, and not just by the whims of people in the authority and power. Such change represents a mutual voice of agreement and would be more grounded.

As the previous chapters elaborated on, the issue of Arsenic contamination in West Bengal does not only represent the physical risk of water contamination; but also represent the deeply held mental models people have of the risk and how it impacts their lives. These mental models, developed through a multiplicity of historical, social, cultural, and structural factors; impact and hinder people’s personal agency in perceiving and mitigating the risk. This complicated interplay between physical risk and socially constructed risk makes it a multi-layered problem. Given this complex nature of the issue, risk mitigation needs to be multidimensional as well. Changing water quality and providing cleaner water might be only immediate and part of the solution; but more importantly, those deeply held mental models need to be broken to make space for new ones, with personal agency and understanding of why a change is required. Any attempt to change people’s behavior without developing their personal
agency in internalizing and understanding the reason and processes of change, and without corresponding structural changes that had caused the risk, would be short-lived and unsustainable. A sustainable change can be affected only by bringing change in the behavior through corresponding culture-centered systemic changes in the structure of water governance and stakeholders’ agency, and by creating platform for continuous dialogues between stakeholders. This understanding of social constructedness of risks, and need for change through consideration of structure, culture, and agency is both the starting point of this dissertation, as well as its outcome. It also sets it apart as a communication dissertation, as it makes an endeavor to understand and suggest not only the tangible changes necessary to mitigate the physical risk associated with contaminated water, but also the symbolic changes in the thought-process and communication in the stakeholders, to break the old mental models of the risk and personal agency, and develop new ones.

As a participatory research, an integral part of the research process of the current research was to understand the issue from the stakeholders’ points of view and ask for suggestions that they themselves considered would sustainably mitigate the risk. Throughout the research, the stakeholders shared similar concerns and suggested similar ‘solutions’. Nevertheless, it was apparent that a major historic issue is the lack of coordinated understanding between these stakeholders. Nobody has ever endeavored to move from their individual positions of power, nor have they tried to understand each other within their own contexts. As a result, various stakeholders blame each other for lack of action.

Breaking with historic precedence, the current research provided a space for self-introspection to the stakeholders, and as a result, they came up with some action-oriented
suggestions that they believed would help bring about positive changes in risk perception, and mitigation behaviors. Theoretically grounded research is frequently used in community-based participatory approaches, to plan and implement development initiatives on ground. This final chapter of the dissertation responds to that need of CBPR, and provides suggestions that emerged from the discussions with the participants during the fieldwork. These suggestions are then discussed in the light of emerging trends in water service delivery in other low-income and developing countries around the world. It also discusses and suggests a collaborative water management strategy, and culture-centered, community-based, communication plan, to mitigate the Arsenic contamination risk in West Bengal.

The suggestions provided by the stakeholders reflect their concern with both structure of the water service delivery, and their personal agency of changing their behaviors to adopt more water-safe behaviors, while considering the cultural contexts in which these actions need to take place. These suggestions manifest their potential to break free from the historic mental models, and willingness to build new ones. The following sections focus primarily on three areas in mitigating the issue: (1) structural changes required to improve delivery of water, such as role of government in water service delivery, building of public-private-people’s partnership models and its success factors, financing system and monitoring of performance; (2) structural changes required to improve community health and prevent further health impacts of contamination, such as involvement of primary health workers in community-based health communication, research and development of health risks from Arsenic, and doctors’ training; and (3) socio-political and communicative changes to develop stakeholder involvement, engagement, consultation, greater political participation and decision-making, and creating feedback loop to ensure accountability.
of stakeholders at all levels.

**Role of government in water service delivery**

Even though this dissertation found multiple structural issues with water distribution, governance and power relations between government at different levels and end-user communities, the need for government’s continuing role in water service delivery cannot be ignored. This is especially true given the poor economic condition of the region, the historically socialist political/economic structure, and the low purchasing power of end-users. Therefore, this dissertation attempts to make a case for continued government involvement in water service delivery, that would be collaborative, community-based, and participatory. The Easement Act of 1882 provides every landowner in India with the right to collect and dispose, within his/her own limits, all water under the land and on the surface. This increasingly limits access to water to those who do not own any land, unless water is provided by the government. Also, a large number of water sources in India are government-owned, such as surface water and groundwater under public lands, and water distribution lines are more likely to pass through government-owned lands and public roads. If water has to be procured from those, it needs direct government intervention. In addition, if landowners are given free right to procure water for themselves without government regulations, there is possibility of over extraction, leading to resource depletion and pollution. Unlike other services, provision of water is not the only service that is attached with water, water quality also has to be maintained, and has to be purified for safety of use. Such examples call for continued government intervention in water services delivery as a welfare measure, to ensure an equitable access to water.

At the same time, population of India, and especially West Bengal is so massive that
providing water for free of cost takes considerable financial resources from the government. Providing water to all the remote areas requires significant manpower and other resources that adds to the cost of water service delivery. Additionally, if government is the only agency involved in provision of water, it might lead to several other issues, such as delayed and poor quality of service; negligence and poor water quality; poor quality of infrastructure; adequacy and accessibility issues; corruption and nepotism in actual distribution, and such. Having said that, several arguments were extended by the participants on the level of government engagement in water service delivery. Government should prioritize its role in the welfare programs. If all the services are provided free-of-cost, government cannot manage both the financial, infrastructural, and administrative aspects of water services delivery. It cannot ensure that government provides services in all geographic areas, with the same quality. This issue of poor quality of service is evident in different levels of water service delivery in rural and urban areas of West Bengal. Also, participants acknowledged that users often tend to not appreciate the value of the products or the services they do not pay for, and also does not trust the quality. Therefore, best service can be provided when its need assessment, and implementation is done by engaging multiple stakeholders, such as local governments, civil society, and communities, so that each stakeholder group understands the challenges others are facing and works collaboratively to develop an implementation and financing plan that suits everyone’s needs. The purpose of government services based on welfare should also be building of personal and collective agency of the communities and its members, and ensuring long-term sustainable development; and not only providing direct solution to people without building their accountability. One of the ways welfare-based government programs can be sustainable is by
making profit models and village based social entrepreneurship that would ensure better sustainability and higher accountability. Entrepreneurship development and profit models create opportunities for private sector and corporate involvement in any kind of public service delivery, including water. Creation of private-public model, for public service delivery ensure greater efficiency and lessen the burden of welfare programs from the government.

**Public-private-people’s partnership**

To facilitate greater and improved access to cleaner water and sanitation, developing country governments around the world are increasingly looking to the private sector, because the public sector alone lacks the resources and capacity to provide universal access to water. Many of the developing country governments, including India, face pressing issues such as large populations, expansion of urban population, growing industrialization on one hand, and lack of economic means and technological know-how on the other. Domestic private sector has tremendous opportunities (WSP, 2010). In West Bengal, even with government control in water services delivery, it was found that many people turn to self-supply, such as illegally tapping into water supply pipelines, or alternative sources such as bottled water. While the self-supply methods are potentially unreliable in terms of actual supply, and dangerous for water quality as it is easy for contamination to seep in in an unregulated tap; alternative methods such as bottled water from a private supplier are expensive and unsustainable in low-income areas, and providers may compromise with water quality to reduce cost. In both cases, entities assisting the villagers in procuring water are local private sector, both organized and unorganized. These local and unorganized practices manifest two important factors in water service delivery: on one hand, it shows that end-user communities may exercise personal agency in availing water when
access to government-supplied safe water is limited and alternatives are available; and on the other hand, it shows a need for more organized and regulated involvement of private sector in service delivery. These private sector actors already play an important role in providing wider, and decentralized access to the villagers. Research by international aid agencies shows that decentralized delivery is cost-effective due to lower operation cost of water delivery through short-distance piped network and more efficient for ease of maintenance (OECD, 2007; WSP, 2010; World Bank 2004, 2006).

In addition, massive increase in the roll out of delivery of cleaner, purified water will require significant investment, as well as improvements in management of the utilities, something already cash-ridden state government of West Bengal and Government of India cannot possibly achieve only by themselves. Experience around the world shows that cooperatively public and private sector can deliver affordable, sustainable, high quality water services, as they can share work responsibilities and cost. Cooperative services increase both administrative capacity and financial sustainability of the service providers, provided there are reasonable regulatory and institutional frameworks in place (WSP, 2010; Jensen, 2016; Ndaw, 2016; OECD, 2013).

Even though private involvement in water service delivery is highly desirable to ensure higher access to water services, such involvement cannot purely be based on market terms. This means, if only private operators operate without government involvement at all, tariff determination might be done based on the actual cost of operation. This has likelihood of increasing the tariff leaving it unaffordable to end-users, especially in rural areas such as the villages in West Bengal. This in turn increases the likelihood of users’ using untreated water or
adopt illegal means to tap water. Also, a pure market-driven service delivery might mean that private actors will not venture into seemingly unprofitable locations, such as geographically remote, and poverty-stricken areas.

The last, but possibly the most important player in ensuring sustainable delivery of water are the end-users in the village communities. The current research, and other research around the world have exemplified that it is crucially important to understand the local historic, political, economic, social, cultural and structural issues of the areas where water service delivery has to be improved. Without consideration of the local contexts, any new program might get into the same problems old programs may have been facing. To ensure that the local contexts are properly taken into consideration, communities’ participation in need-assessment, planning, and implementation is vital, without which no service delivery programs can be truly successful. It is the end-users who are the target beneficiaries of the service delivery, and therefore they should be at the helm of decision-making. Therefore, public-private-people’s partnership (PPP) model is frequently found to be the most viable option in pro-poor public service delivery, including water service delivery (Obosi, 2011; Marin et al, 2009; Davis, 2005).

Charles (2006) Argue that public-private-people’s partnership without proper support and buy-in from the local governments and end-user communities can worsen infrastructure and service delivery and so unlikely to benefit anyone. An evaluation of collaborative water service delivery by World Sanitation Program (WSP) in seven low-income African countries proposed a framework for setting up sustainable decentralized water service delivery through short-distance pipes. The framework urges to consider and address the local issues related to structure, culture and agency, and comprises four building blocks: (1) improving contracting practices to ensure
effective collaboration and communication between all stakeholders (communities/consumers, government and private sector operators); (2) collaboratively design an enabling environment for the private sector operators to ensure regulation, access to maintenance, and financial services and products; (3) building collective and personal capacities of all stakeholders to ensure adequate asset holding authority, proper use of resources, regulation, and performance monitoring; and, (4) developing sound information and communication tools and services to improve performance monitoring, reporting and sharing of lessons (WSP, 2010).

As WSP outlines above, no development interventions can truly be successful without democratic processes, people’s understanding and participation in decision-making, and continuous communication between all stakeholders. Around the world, several participatory processes have been adopted, especially for the management of natural resources, which directly impact health and wellbeing of the communities, especially rural, low-income communities. But many of those have not only been insufficient, but incapable of ensuring that rural communities’ interests are well taken care off. Throughout this dissertation, it has been reiterated that primary reasons for slow or lack of risk mitigation are not related to incapability of the government, but lack of communication between the stakeholders which results in interventions that are not considerate of the structural challenges and cultural needs of the people. This goes on in circles, as lack of communication leads to a socio-political structure that perpetuates this gap in communication and continues to marginalize people. To break this circle, people’s participation and consultation should be at the heart of any intervention—not only as a beneficiary, but as decision-makers. There might be an argument that political democratic processes are already representative of people’s choices and opinions, but there has been enough evidence to suggest
that democratic processes are macro-level whereas intervention projects need more micro-level participation from communities who are directly affected. Macro-level political participation does not create opportunities for direct involvement of community members in decision-making of matters at the micro-level, such as the water service delivery in one’s village. Micro-level participation is needed to ensure the communities are directly involved in the decision-making, and such decisions are representative of the communities’ needs. Such participation also develops personal and collective agency of the communities. Development interventions will be more successful and sustainable if the communities are better prepared and accountable of their actions.

With sound pre-planning, sustainable management, equitable involvement and transparent communication between the stakeholders, collaborative water services delivery models have tremendous opportunity for mitigation of Arsenic contamination risk in West Bengal, and can ensure water security (both distribution and quality), improved health and overall development of the villages. Even within the existing governance structure, arguments were made by several participants in favor of enabling Panchayat system with more autonomous power of administrative and financial decision-making, regulation, and downward accountability to people. The expectation is micro-level implementation of policies by the Panchayat may be more successful, due to their proximity to the needs, demands and challenges faced by the village communities.

Participation and decentralized governance have a symbiotic relationship, as successful decentralized governance necessarily requires some level of local participation. Currently, the water service delivery in the villages of North 24 Paraganas of West Bengal is done at the Block
level, and decisions are centrally taken at the Block office by the Block Development Officer who is a bureaucrat and is unlikely to be well-aware of the socio-cultural needs, structural challenges, and water access and quality issues in the individual villages. Therefore, more often the decisions are blanket implementation of centrally designed policies and plans which may or may not have relevance and support of all the village communities across the country or a state. However, if planning and implementation is done at the Panchayat level, Panchayat members’ proximity to the villages may enable them to understand the local needs better and therefore, respond to those needs and efficiently spend. At the same time, this process of decentralization can itself enhance the opportunities for participation by placing more power and resources at a closer, more familiar, more easily influenced level of government. Making Panchayat members more efficient, responsible and accountable can be an important step in creating regular, and regulated opportunities for community involvement in decision-making. However, such organizational and administrative decentralization in water service delivery would not make any significant long-term difference without providing opportunities for true participation in the hands of people, decision making opportunities (not only political through decentralized governance but direct vigilance by people), increasing downward accountability of political representatives, bureaucrats and public service officials.

**Financing water service delivery**

One of the biggest challenges that the governments both at the federal and state levels face is the lack of financial resources to support quality water service delivery. Even though the state government of West Bengal directly provide the services, they either get money from the federal government, who in turn either borrow money from development banks all around the
world, or get donations in the form of grants-in-aids. Either way, the federal governments run into debt, and must monitor and manage the spending very minutely and efficiently as they are often answerable to the loaning or granting agencies. In case of water service delivery in India, the current financing models based on welfare economy have not been very successful. A new financing model is definitely the need of the hour. Result-Based Financing is increasingly proving to be an effective model for financing rural water-service delivery in low-income communities, which gives power and control to all stakeholders involved; and may be considered as an option in creating new financing models for water service delivery in West Bengal.

Results-based financing (RBF) model is any program where the principal sets financial or other incentives for an agent to deliver predefined outputs or outcomes and rewards the achievement of these results upon verification (Musgrove 2010). In RBF in public service delivery, the principal is usually a donor, or national or sub-national government body of a developing country, and the agent can be a local government, bureaucratic organization, or a private sector partner directly engaged with actual delivery. In an RBF program, payments are made based on the quantity and quality of services delivered after verification (International Bank for Reconstruction and Development/The World Bank, 2013). RBF may be funded by domestic funds, by donor funds or by a combination of both (Klingebiel 2012). It links financing to pre-determined results, with payment made only upon verification that the agreed-upon results have actually been delivered. By setting such financial incentives for service providers to deliver good performance, RBF can help improve both supply and demand side performance.

Over the last ten years, RBF has been used for improving public service delivery across developing countries, such as education, health, water, etc. The most important benefits
associated with RBF are:

- Better quality of services because incentives are placed on quality and timely delivery,
- Reduced corruption, due to increased transparency in the results-payment link,
- Change in culture, from budget-driven to results-oriented,
- Closer supervision as this is a necessary condition to issue payments,
- Sustainability, particularly if the indicators are tracked throughout the project life,
- Increased autonomy for the implementing agency as to “how” to deliver the results.

RBF can involve multiple stakeholders and can include variety of multi-stakeholder arrangements between donor, government, private sector and user communities, as elaborated in the attached figure on the right. As shown here, a variety of stakeholders may take up the role of both principal and agent, depending on the financial incentives and implementation mandates. RBF can create great opportunities for better water service delivery in West Bengal, regularize the current infrastructure and service delivery models, and mitigate the physical risk from contamination in a phased manner.

**Suggested risk mitigation plan**

However, mitigation of contamination from physical risk is not the only issue that needs a long-term and sustainable solution. Contrary to the dominant belief that communities cannot perceive and mitigate the risk because they do not have the knowledge, education and financial
capacity to understand it, this dissertation found that the onus is more on the government for not being able to create an enabling environment for effectively disseminating information, education and communication to/with the communities. Evidently, there is chronic lack and gap of communication between the stakeholders, and whatever little communication takes place lacks consistency and transparency. This lack of communicativeness leads to several other problems that has hindered success of the mitigation initiatives in the past: communities’ distrust in the government authorities, corruption in installing deep tubewells, nepotism in selection of location for new tubewells, lack of consumers’ accountability in safekeep of the community water sources- all these have challenged sustainability. In addition, various other crucial activities not associated with direct installation of technology, such as continuity in testing, closing or marking tubewells with high contamination; maintenance and troubleshooting of existing filters; disposal of the filters after their life-cycle; engaging communities in continuous dialogue about need assessment, planning and implementation of delivery; continuous community engagement to inform, educate and communicate to people to switch to an alternative water source; and creating better healthcare opportunities for patients already victims of contamination have also been hindered due to lack of established channels of communication and feedback between stakeholders. These are equally important to facilitate effective and sustainable mitigation of risk and water service delivery, but have received limited attention due to lack of funds to carry out these activities. Results-based financing has the potential to generate accountability in all stakeholders: governments, private contractors, and end-users, and ensure sustainability of the results.

In an attempt to break the chronic ‘silence’ between the stakeholders; all participants of
the fieldwork, irrespective of their educational qualifications or social positions, were asked their suggestions about the reforms that can be brought about to mitigate the risk. This dissertation bears proof that all stakeholders involved with the issue have personal and collective capacities to identify reforms that directly address their concerns and needs. Stakeholders identified three most important needs for reform: (1) Technology installation (in the form of deep tubewells, arsenic removal plants or point-of-use arsenic filters) that follows the need for such technology by the population and not driven by local (political or personal) demands; followed up by regular testing, monitoring and maintenance of the installations; (2) Development of new facilities and strengthening of existing facilities of healthcare to immediately identify and address health problems from Arsenic contamination in the affected areas, followed up by regular communication between the affected/at-risk communities and medical service providers; and (3) Development of social initiatives to build community capacities and awareness of the issue; create socio-political structure to engage communities in decision-making; establish regular channels of information, education and communication, and multi-stakeholder consultations to develop concerted effort among all stakeholders.

Mitigation of Arsenic contamination risk needs to address the issue both at macro and micro levels, and needs to build capacities of all stakeholders to carry out the mitigation plans. The following section provides some actionable plans, that was developed from the suggestions shared by the multi-stakeholder participants from the fieldwork.

1. Technology installation (to supply Arsenic-free water) that follows the need for such technology by the population and not driven by local (political or personal) demands;

2. Regular testing, monitoring and maintenance of the installations;
Given the risk situation in West Bengal, the primary requirement identified by all stakeholders was technology solution and financing for procuring effective technology solutions, installing and maintaining them. Currently, in most of the villages in West Bengal, this runs completely through government financing, with either negligible or no financing from people. Even when people pay, they pay for the service, not for installation; therefore, evasion of payments becomes quite easy when not closely monitored. With performance-based financing model, this process can be somewhat reversed. State government may create a mandate for the Panchayat and Block Development Office to generate funds from the potential consumers before installation of technology, and government should only agree to provide matching funds. This creates a pressure for the Panchayat and Block Development Office to perform, and consumers to be more accountable.

1. The private-public-people’s partnership model of fund generation may enable the government to generate funds needed to install more relevant and effective technology in villages. Along with this, performance-based financing and the clause for matching fund or part-funding (depending on the financial condition of various locations) may help to develop both government, bureaucracy and consumer accountability. This may also ensure that consumers care for the installed technologies, and may pressurize government for better service. This may ensure timely delivery and quality of pre- and post-installation service.

After installation, monthly payment may be collected from the consumers for upkeep and maintenance of the water delivery points. Similar to the payment model followed during installation, the maintenance staff’s payment may be shared by the government and consumers. To promote entrepreneurship in the village economy, local village youth may be trained to work
on every aspect of maintaining water security and safekeep. This will not only generate village employment, but also may ensure regular and improved communication, and lessen the chances of creation of strict power structures between end-users and service delivery team.

2. Government also needs to create more opportunities for research and development, both at the local, regional, national and international levels on Arsenic contamination risk mitigation. Role of academia, scientists and doctors is crucial here. The school and college teachers, doctors and scientists interviewed during the fieldwork voiced their concern for their lack of direct involvement in raising awareness, and research and development of the technology and mitigation solutions. This is one area where further research is needed. More involvement of social scientists in developing communication plans and educational initiatives were also identified and stressed upon as a need.

3. **Building new facilities and strengthening existing facilities of healthcare to immediately identify and address health problems from Arsenic contamination in the affected areas.**

It was identified that building a better infrastructure for mitigation of health risks from contamination is another crucially important area that needs immediate attention. It requires concerted efforts from primary healthcare centers and community-based primary healthcare workers, government hospitals and private practitioners in proximity to the contaminated areas, and medical colleges. The whole ecosystem of healthcare service delivery organizations in the at-risk villages, both public and private, needs to build capacities of medical professionals to handle the issue.

1. The most important role lies on the primary health care workers. During the focus
group with the primary health workers or ASHA workers, the participants mentioned that, even though the ASHA workers are trained to talk about water quality issues and water purification, these conversations are limited to bacterial/fecal infection of water. They currently did not consider themselves capable of talking about Arsenic contamination risk. At the same time, the primary health workers considered that due to their close access to the villager communities, they can be highly instrumental both in mitigating the health risks by identifying the early signs of contamination, and generating awareness among the community members. They showed great interest and enthusiasm to take up this additional responsibility to inform villagers of Arsenic contamination risk. Need for training and capacity building of the ASHA workers about Arsenic contamination health risks and personal mitigation behavior was identified and voiced. This is another area where urgent need for further research exists.

2. Formal training of medical students and refresher training for practicing doctors is needed to build and develop their capacities to identify and mitigate health-impacts from the contamination. The doctor-participants during the fieldwork identified serious lack of educational materials and training components in doctor’s training to identify infection and contamination from Arsenic. There is also serious lack of research around contamination risk, mandatory medical camps, related to Arsenic contamination. Given the intensity of the crisis in West Bengal, doctor-participants suggested that all local doctors, nurses and medical assistants in Arsenic-contaminated Blocks of West Bengal are given training to be able to identify the symptoms of the diseases due to infection from contamination, and send for referral when they are not able to treat a patient. They also suggested improved communication and feedback between the medical professionals at all levels, including primary health workers.
3. A results-based financing model from International donor agencies to governments and medical/nursing colleges may prove to be effective to bring about change in healthcare provision. Inclusion of new course materials, new research and publications, and in-service trainings for both doctors, nurses and primary health workers are some results that can be the basis of financing.

4. There is tremendous need for more primary health centers and hospitals, primary health workers, and registered specialist medical professionals in Arsenic affected areas (such as dermatology, oncology, nephrology), medical testing services, and such. Results-based/matching grant-based financing model (in a phased manner) would be an effective way to build capacities and ensure maintenance without corruptions.

5. Better transportation between villages and medical centers in the district headquarters was another important area that was identified by all stakeholders. Currently, both private and public modes of transport between villages and medical centers outside the village is very poor, and is a major reason why people avoid to seek medical advices outside the villages. Improvement of reliable and cost-effective public transportation was identified as a crucial need to improve healthcare access.

5. Develop social initiatives to advance people’s awareness and build capacities to identify and mitigate risks from using contaminated water.

Even though the current research brings out that the issues with risk perception and mitigation emanates from community’s challenges with the structural opportunities, cultural barriers and lack of perceived personal agency in risk mitigation, participants also mentioned of a need for capacity-building about the environmental reasons, health impacts, and effective
mitigation strategies. Several villagers considerably themselves highly unaware about the physical qualities of the risk, its health effects, and what personal mitigation behaviors they should adopt. Need for training of the communities on these aspects is a crucial need, and a potential area for further research.

   1. Need for interactive training to generate awareness about the risk among end-user community was greatly stressed. However, it was also acknowledged that there are more villagers who are aware of the presence of contaminant in water than those who are not. Therefore, more than the knowledge of actual contamination, there is need to bring awareness about the short-term and long-term health effects of the contamination, and the changes in behavior that people need to adopt. The ultimate aim is to develop personal agency for risk mitigation, within the structural and cultural constraints people face. Training therefore should focus on knowledge of contamination, its health effects, water-safe behavior for risk mitigation, and developing an effective attitude towards adopting those behaviors.

   2. Local civil society and community-based organizations, including local youth clubs and faith-based organizations can be trained by the government and doctors/scientists to conduct trainings, awareness campaigns, multi-stakeholder meetings with the end-user communities, to generate awareness about the need, importance and ways of maintaining Arsenic-safe water habits; and build their capacities to further engage them with need assessment, planning and implementation of mitigation.

   3. It was identified and suggested that different strategies of training, communication, education and consultation are adopted for men and women, due to their very different socio-cultural positions in the society, and their differential access to resources and
personal networks. Men and women also have different personal networks. For example, men often meet friends after work, in tea shops or in barber shops, a common meeting spot for men in rural areas. However, women don’t have access to those places. Women meet friends in each other’s houses, in common water points and in temples. Strategies may also be different among population groups from different religions. For example, while many Muslim men go to mosques almost every day, or at least once a week for prayer; mosques are largely out of bounds for Muslim women. On the other hand, temples are frequented by Hindu women, but not so frequently attended by Hindu men in the villages unless there is a special festival or other events. These differences in their accessing different village resources are crucial in planning any kind of communication with the stakeholder. However, these may not be consistent across villages. Therefore, thorough and continued engagement of end-users is essential to ensure that a relevant communication strategy is designed and adopted.

4. Training of different stakeholder groups was identified as a critical and urgent requirement. However, training programs are often neglected due to lack of funds. To facilitate trainings, trainings may be organized and part-funded by the government. Government may engage non-governmental organizations, through competitive bids, to organize the initial training of village youth as master trainers while the subsequent trainings are conducted independently by village youth. NGOs may be asked to procure additional funding from other sources than the district governments. This way, village based employment can also be generated. Government funding may be contingent upon/released upon performance, such as after conducting stipulated number of trainings, impact assessment surveys with consumers to understand impact of the trainings, and like.
5. Training through *Panchayat* meetings, medical camps, parent-teacher meetings in local schools, and weekly informational meetings at the primary health centers, by teachers, doctors and primary health workers (ASHA/Anganwari) were also mentioned by the participants as potentially effective opportunities for continuous training and awareness. It was mentioned that continuous and consistent information and communication is important to raise awareness of the issue, bring behavior change and sustain it so that end-user communities do not fall back to old water behavior.

Along with concrete planning, it is important to identify the intended or expected Outcome, Output and Impact from mitigation plans, and how the performance would be evaluated and monitored. DfID defines outputs as the tangible and intangible products that result from project activities; outcomes as the benefits that a project or intervention is designed to deliver; and impacts as higher level strategic goals (DfID, 2016). In the context of water contamination issue with Arsenic, output would be increased number of clean water sources, such as taps, tubewells; outcomes would be reliable and quality water service delivery, and better healthcare delivery; and impact, such as increased quantity, improved quality and higher access to water and health care, better knowledge about the environmental health risk as a whole, and improvements in overall health. Performance monitoring of Outcome, Output and Impact is not only important to measure the success of the plans, it also brings out what worked and what did not, to plan for future. It creates opportunities for a feedback loop that would be instrumental in ensuring that the plans work, and future initiatives are planned based on the success factors. Clear targets and indicators of success need to be set along with implementation with realistic goals, through multi-stakeholder involvement in the decision-making process. Performance
monitoring plan is especially necessary in case of result-based financing.

For the Arsenic contamination mitigation plan that have been discussed above, outcome in this context is improved water quality, improved health, and continued communication between various stakeholders. It is hard to differentiate the first two outcomes (improved water quality, improved health) in case of environmental contaminations leading to compromised health. In fact, no environmental contamination comes to the level of serious concern until it has serious repercussions on human health. The case that is mentioned here has serious repercussions in both health and wellbeing of human and non-human animals.

To elaborate, improved water service delivery will lead to improved water quality, and improved water quality will lead to improved health. Any impact on the environment is inseparable from impact on the health. It is not possible to jump the gun by providing better health care service if corresponding changes are not made for environmental sustainability and provision of safe water. At the same time, if the community capacity is not developed to bring about change in their water behavior, mitigation may not be sustainable. Therefore, the desired outcome of mitigation should include improvement in water quality through distribution of better water services and infrastructure, improvement of health care facilities development of people’s capacity and personal agency in understanding of water issues followed by behavior change.

**Performance monitoring**

Several performance monitoring strategies exist, and have been used in developing countries to ‘monitor and evaluate’ pro-poor public service delivery. Involving communities in both planning and implementation of performance monitoring is absolutely critical, to ensure that the plans reflect community need. Performance monitoring has many crucial functions in a
development program, as it ensures that the communities keep track of what is happening, and communities are continuously engaged with the progress of the initiatives. By creating a feedback loop between the stakeholders, it also has high potential of generating and maintaining communication between the stakeholders.

Multiple qualitative and quantitative measures have been adopted in developing countries around the world, such as Most Significant Change storytelling (originally developed by Dr. Rick Davies in 2002, end-users or community members share stories of significant changes a particular development program or service has had of them, and then collaboratively decide which stories of change are the most effective and why); citizen audits (end-user communities audit the performance of government or the development agencies through pre-defined measures; community score cards (originally developed by CARE Malawi in 2002, Community Score Card brings together the demand side (service user) and the supply side (service provider) of a particular service or program to jointly analyze issues underlying service delivery problems and find a common and shared way of addressing those issues); surveys (quantitative impact assessment surveys based on pre-defined measures), to name a few. CCA and mental models research approaches may also be further used for performance monitoring, and can be combined with many of these measures.

To ensure success of an intervention aiming at natural resources management and health behavior change, accountability is required at multiple levels. As elaborated throughout this dissertation, even though the issue of Arsenic contamination is multi-layered and complex, chronic lack of communication between stakeholders lies at the heart of it, and it also causes lack of trust and accountability between stakeholders. Likewise, developing regular channels of
communication, as outlined by the stakeholders, would be able to bridge the gap in communication and bring all stakeholders on a shared platform. Thorough involvement of all stakeholders: government, funding agencies, community-based organizations, medical professionals, scientists and communities, to understand each other’s needs, challenges and roles is key to monitoring progress, success, bottlenecks, and increase accountability. Due to low use of news media, monitoring and communication may not be effective through mass media. Therefore, popular media, community media, interpersonal networks and repeated interaction between stakeholders, through village meetings and focus groups might be effective strategies.

Continuous, repeated and sustained community involvement through communication, education, training, and capacity building have proven to increase interest and personal agency of the communities in the interventions. Community capacity and interest will also increase demand for information from the government which will in turn increase political accountability leading to improved service. Introduction of objective and subjective measures of monitoring and feedback such as performance/output-based aids; and by the community through experience-sharing through stories, photos; citizen audits and community score cards will mandate accountability from all parties involved. Evidence-based needs and impact assessment is not only effective for one community, but provides basis of a working model that can be adopted for large-scale interventions. Sharing of best practices across communities with need for similar interventions will facilitate other communities to adopt these practices and mitigate local issues. Such a strategy increases buy-in from community and increases competition from all stakeholders, ultimately ensuring sustainable development of village communities.
Conclusion

Development practitioners have always argued in favor of theory-based development interventions (Barbara et al. 2008; Parsai, Castro, Marsiglia, Harthun, & Valdez, 2011), and this dissertation was an attempt to theoretically understand a real-life problem, and seek suggestions from the involved stakeholders on their vision of how change can be initiated. In case of environmental health risk mitigation, theory-based interventions provide the understanding of the structural challenges people face in changing behavior, and how health risks can be mitigated by managing environmental resources better. There are multiple reasons why theory-based interventions are effective. As this dissertation brings to light, inability to address or mitigate a risk by communities and government are not always lack of knowledge and lack of intent, respectively. It is the structural, cultural and agentic factors that hinder change, and theory-based interventions have an opportunity to understand the background of the problem. The mental models approach adopted in this dissertation helped to bring to light the extent to which communities connect the Arsenic contamination issue with historical, structural, and cultural factors. Community-based participatory research approaches call for theoretically grounded research to understand the background of a real-life problem it seeks to address, and this dissertation may serve as the theoretically grounded baseline research for planning and implementation of a community-based risk mitigation strategy for Arsenic risk mitigation in West Bengal. Unique contribution this dissertation is that it attempts to be theoretically grounded, practically relatable, and pragmatically implementable. This theoretical grounding will also ensure that the learning from this dissertation can be applied in other geographic and issue areas, with similar historical, social, cultural, structural and developmental barriers.
Figure 19: Summary of plans shared by the participants during fieldwork

Arsenic Mitigation Plan

Technological Mitigation & Implementation

For districts with easy access to surface water
- Filtration and chlorination of surface water using renewable/biomass energy
- Simple non-mechanized rust and sand filter to households

For districts without easy access to surface water
- Digging dugwells
- Delivering water to communities

Long-term
- Pipelines with 2-3 outlets to each neighborhood
- Pipelines to each household

Short-term
- Bullock cart driven/motorized water bowser

Water bowser:
- Each day/alternative day at a religion/gender neutral place
- Local self-govt office
- School Premises

Social Mitigation & Implementation

- Engaging village youth, social/religious groups, educational institutions, and local government.
- Separate strategies for men & women

Men
- Risk messages at the mosques/temples/post offices written and pictorial
- Engaging the religious leaders
- Engaging the local youth through the clubs/NGOs
- Sending male youth from district colleges for field work on course-credits
- Engaging Civil Society

Women
- Risk messages at the health care centers/door-to-door campaign by primary health workers (ASHA)
- Sending female youth from district colleges for field work on course-credits/local NGOs
- Educating the school children and encouraging them to talk to their mothers
- Engaging Civil Society

Training Programs
- Awareness Campaign: Religious leaders, Educational Institutions, Civil Societies, Clubs
- Program management: Local Self-govt, NGOs
- Implementation: NGOs, local clubs
BIBLIOGRAPHY


Science, 40, 17-30.


Balazs, C. L., & Morello-Frosch, R. (2013). The three Rs: How community-based participatory research strengthens the rigor, relevance, and reach of science. *Environmental Justice, 6*(1), 9-16.


Chan, K. M., Satterfield, T., & Goldstein, J. (2012). Rethinking ecosystem services to better address and navigate cultural values. *Ecological economics*, 74, 8-18.


21.


Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate


Lowe, T. D., & Lorenzoni, I. (2007). Danger is all around: Eliciting expert perceptions...
for managing climate change through a mental models approach. *Global Environmental Change, 17*(1), 131-146.


McDaniels, T., Axelrod, L.J. and Slovic, P. (1995) Characterizing perception of


Parajuli, K. (2013). Rural methods to mitigate arsenic contaminated water.


Ravnborg, H. M., & Westermann, O. (2002). Understanding interdependencies:


Stratford, D., Chamblee, S., Ellerbrock, T. V., Johnson, R., Johnny, W., Abbott, D., ... &


Newbury Park, California, USA.


World health organization (WHO) (2012). UN-water global annual assessment of sanitation and drinking-water (GlAAS) 2012 report: the challenge of extending and sustaining services.


APPENDICES
Appendix 1: Interview protocol | Villagers

1. Demographic questions
   a. Please tell me about yourself,
      i. How old are you?
      ii. What level of education have you achieved?
      iii. How big is your family?
      iv. What is your occupation?
      v. Do you own your house? If not, please explain.
      vi. Do you own your land? If not, please explain.
      vii. What is the source of your household water?
   b. Have you or your family ever been diagnosed with any water borne disease?

2. Please tell me what you know about the water that you use in your village.
   Primary probes
   a. What is the general water quality in the village like? (Is it safe, clean, plentiful? Etc.)
      Secondary probes: How do you know this?
   b. What about surface water pollution?
      How do you know this?
   c. What do you know about arsenic in the groundwater?
      How do you know this?

3. What do you think about the water quality? (probe for evaluative terms like, good, bad, etc.)

4. What should be done about the water, either to preserve it or make it better?

5. Ok, now please tell me about how you and others in your community use the water that you get in your village.
   a. Who uses it (housewives, farmers, etc.)?
      Probe: Who fetches water?
      Probe: what do you think about this?
      Probe: what can or should be done about this (again focused on both positive and negative attitudes)
   b. What do they use it for? (e.g. drinking water, fish farming, irrigation, agriculture, cleaning, laundry etc.)
      Probe: what do you think about this?
      Probe: what can or should be done about this?
   c. How do they use it? (fetching it, boiling it? Filtering it?)
   d. Probe: Do you directly drink the groundwater for drinking or purify them?
   e. Probe: How do you purify water? Do you use any household water treatment/purification measures/devices?
   f. Probe: Is there any (other) water testing facility available in the village/nearby?
g. Probe: What are those and how frequently do you use those?

h. Probe: Are you aware of any govt or NGO/CSO sponsored programs to promote arsenic free water?

i. Probe: Do you know any specific ones that you have used?

j. Probe: Do you know how to identify arsenic free water well?
   Probe: what do you think about this?
   Probe: what can or should be done about this?

k. When do they use it? (every day? A certain time every day?)
   Probe: what do you think about this?
   Probe: what can or should be done about this?

l. Why do they use it? (no choice? Tradition? Ease of access?)
   Probe: what do you think about this?
   Probe: what can or should be done about this?

m. Where do they use it? (at home? In the fields? Etc.)
   Probe: where do you get water from?
   Probe: what do you think about this?
   Probe: what can or should be done about this?

6. Do you fear you have susceptibility to getting contaminated by Arsenic? Why?
   Probe: How do you think you can prevent it?
   Probe: How do you think water can be free of arsenic?
   Probe: Why do you think that (if) you cannot prevent it?
   Probe: Do you perceive barriers in getting greater quantity of uncontaminated water?
   Probe: Who do you think have more chances of contamination? Why?

7. Where do you get information about arsenic contaminated water, about water purification etc?
   Probe: Do you trust the information?
   Probe: Where are the different media you use for information about water quality and otherwise?
   Probe: Do you perceive any barriers in getting and understanding information?
   Probe: Do you trust the water testing procedures and information?
   Probe: Do you think the information is enough?
   Probe: Who do you trust most for information? Why?

8. What are the changes you think can be brought in to improve access to safer water?
   Probe: The way you access groundwater?
   Probe: The way you purify groundwater?
   Probe: Agricultural/irrigation practices?
   Probe: The way contaminated wells are marked?
Appendix 2: Interview protocol | government officials, and scientific experts

1) What do you think is the state of water quality in this region?
2) What do you think about these issues (attitudes)?
3) What do you think can be done about these issues (both the positive and negative issues)?
   a. Probe: In your mind, what are the 5 major water quality issues in this area?
   b. Probe: What do you think are the reasons for these issues?
   c. Probe: Which is the most important? Why?
   d. Probe: What are some of the challenges to resolving these issues?
   e. Probe: What do you think is public perception of these issues? Why?
   f. Probe: What are your goals for dealing with these issues?
   g. Probe: How are you going to accomplish your goals?
   h. Probe: What do you think needs to happen to solve these issues?
   i. Probe: Who do you think is responsible for resolving these issues?

4) What do you think is the public’s perception of water issues?
5) What do you think about their perceptions/knowledge of the issues?
6) What can/should be done about these perceptions?
   a. Probe: What do you think about public perception of water contamination?
   b. Probe: How much do you think they know or understand about the contamination?
   c. Probe: What do you think are the barriers in their understanding of the issue: scientific, social, cultural, religious, historical, communication, etc?
   d. Probe: What do you think can be done about it?
   e. Probe: Who do you think should do that?
   f. Probe: What are the barriers in doing that, if there is any?

7) What individuals and organizations play a role currently in these issues?
8) What do you think about the roles they play/should play?
9) What can be done about participation by these various stakeholders?
   a. Probe: What organizations or individuals play a part in the issues you just spoke about?
   b. Probe: Which organizations have you worked closely with?
      i. Why?
      ii. Do they share your goals?
   c. Probe: How would you describe your interactions with these other groups?
   d. Probe: What are the power dynamics among the groups?
      i. Is one the central group?
   e. Probe: Do you think common people should participate in policy decision making? Why and why not? How?
10) How is information disseminated on this issue?
11) What do you think about how information is disseminated?
12) What can/should be done about how information is disseminated?
   a. Probe: What are your sources of information, and why?
   b. Probe: What information helps you make decisions?
   c. Probe: What information is used to support policy decisions?
      i. What information should be included in these decisions?
   d. Probe: What do you think about the quantity and quality of information that is available?
   e. Probe: Who shares information with you?
      i. Do you trust that information?
   f. Probe: Who do you share information with and how?