

Article

Digital Ethnography? Our Experiences in the Use of SenseMaker for Understanding Gendered Climate Vulnerabilities amongst Marginalized Agrarian Communities

Deepa Joshi ¹, Anna Panagiotou ², Meera Bisht ¹, Upandha Udalgama ^{1,*} and Alexandra Schindler ¹

¹ International Water Management Institute, 127 Sunil Mawatha, Battaramulla 10120, Sri Lanka

² Cognitive Edge (Cynefin Co.), Abergele Road, Colwyn Bay, Conwy LL29 8BF, UK

* Correspondence: u.udalgama@cgiar.org; Tel.: +94-71-990-1800

Abstract: Digital innovations and interventions can potentially revolutionize agri-food systems, especially in coping with climate challenges. On a similar note, digital research tools and methods are increasingly popular for the efficient collection and analysis of real-time, large-scale data. It is claimed that these methods can also minimize subjective biases that are prevalent in traditional qualitative research. However, given the digital divide, especially affecting women and marginalized communities, these innovations could potentially introduce further disparities. To assess these contradictions, we piloted SenseMaker, a digital ethnography tool designed to capture individual, embodied experiences, biases, and perceptions to map vulnerabilities and resilience to climate impacts in the Gaya District in Bihar. Our research shows that this digital tool allows for a systematic co-design of the research framework, allows for the collection of large volumes of data in a relatively short time, and a co-analysis of the research data by the researchers and the researched. This process allowed us to map and capture the complexities of intersectional inequalities in relation to climate change vulnerability. However, we also noted that the application of the tool is influenced by the prior exposure to technology (digital devices) of both the enumerators and researched groups and requires significant resources when implemented in contexts where there is a need to translate the data from local dialects and languages to more dominant languages (English). Most importantly, perceptions, positionalities, and biases of researchers can significantly impact the design of the tool's signification framework, reiterating the fact that researcher bias persists regardless of technological innovations in research methodology.

Keywords: digital ethnography; transdisciplinarity; methodology; SenseMaker; climate change; agriculture; gender



Citation: Joshi, D.; Panagiotou, A.; Bisht, M.; Udalgama, U.; Schindler, A. Digital Ethnography? Our Experiences in the Use of SenseMaker for Understanding Gendered Climate Vulnerabilities amongst Marginalized Agrarian Communities. *Sustainability* **2023**, *15*, 7196. <https://doi.org/10.3390/su15097196>

Academic Editor: Chengpeng Lu

Received: 16 February 2023

Revised: 5 April 2023

Accepted: 22 April 2023

Published: 26 April 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

It is now well acknowledged that the bio-physical dimensions of climate change trigger complex, global, socio-ecological impacts. This is a welcome change in the “epistemological hierarchies” of climate change discourse [1]. However, there is still relatively little attention on how these changes shape the everyday, deeply “embodied experiences” of “marginalized, poor, and vulnerable populations”, especially in the Global South whose “lives and livelihoods” primarily rely on the land, agriculture, and other natural resources [2].

Large numbers of smallholder cultivators as well as the landless poor, relying on the immediate environment for sustenance and income in South Asia, are particularly hard-hit by the effects of climate change on livelihood sustainability and stability. In agrarian economies, livelihood systems that encompass the production, livestock, forestry, and aquaculture sectors face significant stress from climate-induced changes. Increased temperatures, variations in precipitation patterns, weather anomalies, and an upsurge in the frequency of extreme weather events collectively cause crop failures, pest and disease

outbreaks, and degradation of land and water resources [3]. Marginalized groups who have limited material and relational resources are least able to adapt to these changes [4–6].

“The Intergovernmental Panel on Climate Change (IPCC) notes that poverty, coupled with socio-economic, cultural, and political marginalization, renders the most marginalized—particularly women—highly vulnerable to the adverse effects of a changing climate” [5,7,8]. Gendered roles and responsibilities, limited access to productive resources, technology, and information, as well as restrictive sociocultural norms, further compound the susceptibility of women to climate change [9]. To effectively address the socio-ecological consequences of climate change, it is imperative to map the complexities of factors shaping vulnerability and resilience beyond the biophysical aspects of climate change, that is the socio-cultural, economic, and political dimensions of these challenges. Ethnography as a qualitative research methodology has several merits in unpacking these types of complexities.

Ethnography is essentially about “deep hanging out” [10] and about exploring a more critical understanding of individual, embodied experiences, and inter-relations [11]. Historically practiced by anthropologists by physically, informally, and socially immersing themselves with the research subjects for long and extended periods, ethnography is also interesting as it considers issues of how researcher “positionality, relationality, respect, and reciprocity” [11] shape knowledge and interventions. SenseMaker is described as a digital ethnography tool. Our interest in this case was to assess how the practice of ethnography, particularly the deep hanging out of researchers with their research subjects, would be addressed by a digital tool that promised to collect large volumes of data in a relatively short time period.

Digital technology has dramatically altered the perceptions of space, time, and place in social interactions [12], particularly, “by making it possible to connect to otherwise difficult-to-reach communities” ([13], p. 1). In this way, the research space is no longer just physical, it now includes engagements done virtually [14]. New digital innovations are increasingly being experimented with in research, in the documenting, sharing, mining, and locating of everyday experiences—with little to no physical contact with the researched communities.

The more interesting point for us in piloting the application of digital tools, was the promise of the SenseMaker tool in enabling the examination of perceptions, thoughts, and values, and efficiently analyzing large volumes of such qualitative data [15]. Digital tools and technologies allow the collecting and storing of data, including interactions, “words, utterances, messages, exchanges, etc.” [16], as well as their tagging and indexing and the searching of patterns in these narratives.

Finally, it is argued that accomplishing ethnography digitally can minimize researcher subjectivities, by allowing “the researcher to act as a [mere] facilitator in the application of technologically sophisticated mapping and analyses of social relations” ([17], p. 7). Additionally, as we will discuss below, the SenseMaker tool enables researchers to co-design the research with the respondents and allows the “researched” to “make sense” of the data (self-signify it), coding or classifying their narratives in the process. In other words, this has the promise to mitigate subjective biases, as the role of the researcher becomes more facilitative. The transdisciplinary design and approach of the tool was intriguing to us and was the reason why we wanted to assess the use of the tool in mapping embodied experiences of climate vulnerability and resilience in Gaya, South Bihar.

Despite its promise, digitally mediated research remains limited and underexplored. Primarily, this is because access to and use of technology are shaped by social inequalities [18], especially by poverty and gender. A very basic challenge is reaching the economically and socially marginalized with digital research tools [14]. The digital divide also includes the infrastructure divide in relation to access to information and communication technology (ICT). Muller and Aguiar (2022) note that nearly 3.6 billion people remain totally unconnected to the Internet by any measure [19]. There are many more contextual dimensions of the digital divide [19]. Secondly, because “new tools and innovations are of-

ten restricted to dominant languages” ([20], p. 3), significant time and financial investments are needed to apply these in diverse geographic contexts.

According to Kelly ([21], pp. 38–39), there are other reasons for the “methodological conservatism” in the use of new digital technologies in social science research. Firstly, the emphasis in social disciplines is on physical interactions through “doing fieldwork—direct engagement, sustained encounter, and intellectual and emotional openness” are expected research qualities ([21], pp. 38–39). Secondly, field research is expected to be an open-ended, “iterative, reflexive, generative” process, and digital methods and design can be seen as comparatively technocentric, fixed, and unchangeable. Lastly, there can be a bias against digitally based research in terms of publishing results in disciplinary journals or meeting academic expectations and norms, where research is considered a necessary social interaction between the researcher and the researched. We do note that digital ethnography is often sidestepped in ethnographic journals and texts [14,22].

However, we felt that hesitations were also shaped by inherent researcher biases. The SenseMaker design does call for an engagement of the researcher with the researched; the research process is reflexive and iterative; and SenseMaker-related research is increasingly published in social science research platforms.

As the use of tools like SenseMaker gains popularity in research for development, we noted that most publications focus on discussing research findings and outputs. There is almost nothing that focuses on the methodological implications of doing ethnography digitally. Our focus in this paper addresses this gap—the fact that insights on researcher experiences in the use and application of SenseMaker “are lacking” [23].

We situate this paper on the methodological concerns and considerations of accomplishing digital ethnography, and more generally on the issues of researcher subjectivity and positionality. Researcher positionality and reflexivity are particularly important to ethnography, as “what we see—or what we are allowed to see—depends on where we stand and who we are in that moment” ([24], p. 13). The questions we ask in this paper are as follows: Can ethnographic research be done digitally? Does the application of SenseMaker allow mapping and capturing intersectional vulnerabilities to climate change impacts with diminished subjective researcher bias?

Our findings from this study provide evidence that regardless of methodological innovations, researcher positionality and bias significantly impact research design, implementation, and data analysis. The methods and spaces in which research is done might change, but bias, value, power hierarchies, and institutional mandates continue to shape research and science: whether in the mining of digital repositories for social and behavioral patterns or in innovating digital methodologies as new ethnographic tools.

2. Methods: Conceptual Framework

2.1. Context

The district of Gaya in Bihar, the location of our research, is one of India’s most vulnerable and marginalized regions [25]. Here, chronic poverty, marginality, and gender and caste inequality have persisted historically, and continue to shape vulnerabilities as well as coping strategies to climate impacts [26]. South Bihar is particularly susceptible to adverse hydro-meteorological natural disasters, with an especially high risk of drought. Given that there are no state-level climate models or vulnerability studies, and an inadequate level of community awareness, the degree of vulnerability of the marginalized to the impacts of climate change is known to be high but remains relatively unknown [27].

In Bihar, we had firsthand experience with the disciplinary siloes in which climate-technological innovations operate and shape food systems. Often, the focus in responding to climate impacts is on tackling the bio-physical dimensions of changes through technological innovations and instruments in mitigating droughts and floods, increasing crop resistance, and seed variety [28]. Such approaches often render the vulnerabilities, knowledge, capacity, and everyday resilience strategies of marginalized groups, including women, invisible. In other words, “what is not understood does not count”.

Even when social dimensions of climate challenges—livelihood insecurity, nutrition, environmental health risks, incomes, forced migration, etc., are acknowledged, it is assumed, often without evidence, that disciplinary “one size fits all” solutions will address multi-dimensional challenges across diverse local communities. Our hypothesis was that “inequality of opportunities . . . shape inequality of outcomes . . . and impact” [29].

Ethnography as done traditionally offers the tools to deeply hang out and get a critical insight into individual, embodied experiences and inter-relations, which are fundamental to understanding “the inequality of opportunities”. Why were we then, looking for something different (digital tools), to do the same?

2.2. Transdisciplinarity

We had strong reasons to experiment with different ways of doing research. Firstly, as researchers, while we were aware of the strengths and values of ethnography, we were also aware that this approach and method is steeped in a history of colonialism. Amongst other disciplines, “anthropology” has perhaps been most singled out for its “collusion with colonialism” in its design and approach [30]. For a long time, anthropologists, essentially white, Western researchers, studied other people, mostly “natives” from the Third World, the formerly colonized people [31]. Of course, much has changed since then. The discussions now in relation to ethnography are on positionality and the power dimensions between the researcher and the researched. However, as Merriam et al. stress, these relationships (between the researcher and the researched) are “multi-dimensional power relationships—shaped by prevailing cultural values, gender, educational background, and seniority” and remain an issue not to be overlooked ([32], p. 408). In this regard, SenseMaker, positioned as a transformative, transdisciplinary tool, where the researcher’s role is only facilitative, presented an attractive option to us.

Definitions and interpretations of the term “transdisciplinarity” vary significantly [33]. Often, transdisciplinarity is understood as increased coordination between different scientific disciplines. However, in critical social science theory, transdisciplinarity goes beyond the interaction, exchange, and collaboration between research disciplines. Transdisciplinarity here refers to the integration of the researched into the research process [34] for “co-producing knowledge”. This approach requires research and researchers to understand diverse experiences through multiple lenses and lived realities [35]. This addresses the practice of generating knowledge that is steeped in relations of power and positionality, which often ignores and make invisible diverse, plural knowledge traditions [35].

In the planned research, transdisciplinarity was not simply about merging different disciplinary lenses. It was about enabling individual, embodied, experiential, and situated knowledge to inform the understanding of resilience in coping with climate impacts. SenseMaker’s promise of doing “science with society rather than for society” [36] was emphasized in publications on the use of the tool in different geographies, particularly in understanding multidimensional inequalities and climate impacts [37].

As a digital ethnographic tool, SenseMaker promised a pathway to both understanding and addressing the resilience of the marginalized to deal with and overcome intractable challenges [38]. Would the tool live up to its promises? In an increasingly data-driven environment, particularly in relation to agriculture and climate change impacts, we were very keen to explore if the tool would allow “technology to become part of understanding economic and cultural foundations” of long-standing poverty and inequality [38]. In other words, tackling questions like: “Data science by whom? Data science for whom? Data science with whose interests in mind?” [39].

Our focus was on applying the SenseMaker tool and methodology to understand how women at the cross-sections of poverty, landlessness, gender inequality, and caste disparities cope with and mitigate climate impacts in the face of systemic barriers at scale [40]. However, we do not discuss our data, i.e., our research findings in this paper. Our focus here is on analyzing the extent to which this digital tool allowed us to perform research differently. Did our application of SenseMaker allow a “decentering of

researcher knowledge and authority to create more plural spaces of problem identification and interrogation?" ([17], p. 45).

2.3. SenseMaker as a Transdisciplinary Tool in Theory and Practice

In this section, we will discuss how the SenseMaker tool integrates concepts of reflexivity and transdisciplinarity, both in its overall design and in our application.

SenseMaker is a narrative-based method, differing from typical qualitative methods [40] such as interviews. Very simply put, SenseMaker's methodological framework, also known as the signification framework, includes one key question—the prompt or prompting question—which results in the sharing of a micro-narrative, or an experience from everyday life. This prompting question is then further analyzed by a series of qualifying sub-questions to provide more nuance to the shared micro-narrative and reveal attitudes, values, and perceptions behind it. The core idea of the SenseMaker methodology is to enable respondents to self-signify the story or narrative they offered. This is a marked distinction from traditional qualitative processes of participatory research, where there tends to be a "higher" degree of scholarly interpretation done exclusively by the researcher. For a more comprehensive overview of the signification framework and its corresponding components, please refer to Appendix A.

In practice, self-signification happens through *signifiers*, such as triads (see Appendix A). Triads correspond to three interrelated concepts, visually located at the corners of a triangle, with the participant invited to place their story in relation to all three, essentially doing their own coding. Unlike in typical quantitative tools, such as surveys, relationships are emphasized over single scales. The SenseMaker signification framework recognizes that lived experiences can be ambiguous and have multiple connections. In other words, no two individual experiences of a particular issue are the same. Therefore, where in a more typical coding scheme a code is either present or absent, SenseMaker allows interrelated "codes". This allows the participant's individual perspective on these interrelated concepts to emerge: what do they see their narrative most aligned to? The signification framework used by us for the participant end-users is also presented in Appendix A.

The transdisciplinary and relational elements of this methodological tool partly derive from the origins of the tool in complexity science [23,40]. When moving beyond simple categorization and towards trying to engage with real-world complex problems that do not answer to direct correspondences and deductive logic, the prioritization of relationships over discrete items and the deliberate engagement with multiple perspectives and direct, experiential knowledge becomes essential. In that way, SenseMaker embodies some of the digital world's capacities for application at scale, multiple tagging, connection schemes, and amplifying human voices.

Transdisciplinarity both necessitates and enables reflexivity. One of the ways this comes into the SenseMaker design is through the ways it moves between emic and etic ways of knowing. These concepts were originally theorized by Pike [41,42] and are defined by Young (2005) as essential aspects of Participatory Action Research. In ethnography, emic refers to perspectives originating from the culture or society where research is being carried out, while etic refers to external perspectives [43]. The emic or the "insider perspective" can be powerful in addressing social issues and highlighting the voices of those affected or experiencing the problem through active participation [42,44]. SenseMaker's design acts as a creative tension between the etic and the emic. "Outsider" perspectives can also be useful, for example as an alternative viewpoint on cultural dynamics that from the "inside" can be naturalized. The combined processes of co-design and self-signification include both emic and etic aspects and allow them to challenge and benefit one another, as the need to shift between perspectives and lenses aids the reflexive process.

Methodologically, some form of categorization or abstraction is inevitable when we want to make sense of the world around us. So how do we make that categorization more impermanent (so we avoid reification) and more legitimate? The SenseMaker response to this is to create a relational scheme of abstraction (the signifiers) that acts as a heuristic—an

element that helps see or organize the world differently rather than attempting to create permanent and unchanging categories. The legitimation part comes in the participant's role and the transdisciplinary aspects of the tool that almost enforce a degree of reflexivity. The participant's interactions with the signification framework can show us which researcher assumptions might be valid and which need to be challenged, decentering their knowledge and authority.

However, transdisciplinarity is not automatically built into the characteristics of SenseMaker as a tool. Ultimately, it also needs to be a part of the research design process, from the initial approach to framing the prompting question to designing signifiers and interpreting the results.

We applied a feminist political ecology (FPE) perspective in designing the signification framework, as well as in analyzing our experiences in the application of SenseMaker. Such an approach allows mapping experiences and sites of exclusions and inequalities and generates evidence of the gendered dimensions of challenges in agrarian households, without framing gender inequality as a binary. It also helps unpack why these exclusions remain invisible to key institutional actors and are unaccounted for in program interventions. Understanding these systemic bottlenecks can help us identify pathways to resilience that deliberately tackle blatant and latent gender-power norms, barriers, and hierarchies. Emic ways of knowing were built into processes of intentional knowledge co-production, significant in tackling gendered and other power disparities. These enhanced the scope for outreach and impact through engagement with a greater number of relevant stakeholders throughout the research. They also allowed institutional stakeholders to listen to and understand marginalized stakeholders' experiences.

The following «results» section describes in greater detail how signification frameworks were co-designed and piloted to include farmers and agricultural laborers as well as institutional stakeholders. We describe how the SenseMaker tool was employed to collect data and analyze complex social systems related to climate change and agriculture. Specifically, we elaborate on the use of the tool to capture the experiences and perceptions of local farmers in Bihar, highlighting the unique insights gained through the SenseMaker method.

3. Results: Experience of Using SenseMaker: Promises, Challenges, and Implications

The unique nature of the SenseMaker tool allowed us to analyze its relevance both as a research method and in relation to research outputs. We do briefly discuss the research results, particularly in relation to examining our specific experience of implementing the tool.

3.1. The Application of SenseMaker: Reflective Dialogues?

SenseMaker is a narrative-based research tool that emphasizes reflective dialogue [43]. Researchers at the Centre for Social Transitions (CST) at Stellenbosch University, long-term users of the tool, have written about the participatory processes that need to be adhered to, including paying attention to the local context. Transdisciplinarity is essentially about bringing together different knowledge and experiences (academia and societal stakeholders including end-users) in co-producing the research, interpreting research findings, and co-designing solutions for change. CST researchers caution that transdisciplinary research is not easy to implement, because knowledge, finance, and power hierarchies continue to shape who is researched, why, and how. Breda and Swilling point out that research designed in the developed world is not so easily transferable to a developing world context [45].

In the application of SenseMaker, we found that the tool does not explicitly spell out these processes of reflective dialogue. In other words, SenseMaker could be applied to collate and analyze individual narratives with varying degrees of a reflective dialogue process and across the spectrum of participation. The extent to which these principles are applied and adhered to will therefore rely on the research team, and indeed the process is not easy to implement, as is true of all transdisciplinary research.

John van Breda from CST engaged with us during the design phases of this research. It was this engagement that guided us to plan for a series of focus group discussions ($n = 13$) with diverse groups of male and female respondents—smallholders and agricultural laborers, who we term as participant end-users (the term “participant end-users” refers to those who participate in the research study as participants and potential users of the research findings. These individuals were the target audience of the research and were involved in the design, implementation, and analysis of the research). Building on these case studies, we conducted detailed qualitative case studies ($n = 50$) with a representative group prior to designing the signification framework. These discussions allowed us to get a deeper understanding of the intersections of caste, class, and gender in the local communities in the context of a deeply unequal and feudal agrarian system. We were able to quickly establish contact with the local community through our local partner, SumArth, a smallholder farmer collective in the Gaya district in Bihar working primarily with women.

The data we collated was then discussed with a smaller, representative group of the local community, particularly women. This allowed for the validation of data, and, even if indirectly, building a co-design approach in developing the SenseMaker signification framework. We followed a similar, although less extensive, process of data collation and validation with a smaller group ($n = 15$) of institutional stakeholders—primarily staff of local organizations engaged in program implementation.

The design of the signification framework was an elaborate process. First, we developed the framework in English, and then translated this to Hindi, being mindful about adopting a colloquial tone and language that was relevant to the local context. We worked through multiple versions of the framework, drafting the questions in language familiar to the local community through collaboration with the staff of our partner organization, SumArth, who were also locals. Finally, we went through a process of piloting the signification framework and making changes to ensure that the questions were eliciting reflective responses.

None of these iterative processes are emphasized in detail in the formal overview of the tool, or in the standard training and capacity strengthening that is provided in the use of the tool. We went through these processes, informed by prior awareness of ethnographic, transdisciplinary research, as well as of the local context. However, it is possible that other users could be unaware of these processes, and highlighting their importance is one of the intentions of this paper.

Our extensive collaborative processes were not without internal challenges as well. The team of researchers doing the qualitative research prior to designing the signification framework was young, from outside Bihar, and none of them had ever worked in the area. This research team were often critical of the local partner, SumArth, and reported observing patronage and clientelism in the relations between the local partner staff and the community. The research team viewed this as gatekeeping. The local partner on the other hand was wary of researchers. Having worked with the local community for several years, they felt that they knew the challenges and constraints well. They questioned the value of additional research, found the research process imposing on local communities, and were worried that the research would risk raised expectations amongst community members. The point we want to raise here is that regardless of the local context, the co-design of any research is shaped by values, biases, power, and positionality amongst a project team. These issues can be invisible, and often, there is not adequate time to address these concerns. We argue here that the implementation of SenseMaker needs to pay attention to these nuances in the process of designing the signification framework and in knowledge co-production more broadly.

A key strength of SenseMaker is the efficient collection of narratives from significantly large groups of participants, and the collation and analysis of this data in a relatively short time frame. This is what distinguishes the tool from the more traditional ethnographic research, which requires a deep hanging out between the researcher and the researched.

However, we also noted that this is where a collaborative, co-design approach can slip between the cracks.

We intended to collect narratives from 500 plus participants and eventually recorded 597 responses about how diverse groups of female and male farmers experience the impacts of climate change. However, COVID-19 travel restrictions delayed the start of the research. Additionally, we spent around 3 months ensuring a co-design of the signification framework, grounded in the local context. To ensure that we were able to complete the SenseMaker signification framework in time, we recruited a team of male and female students from a local university, and the enumerators eventually included the external team of researchers, SumArth employees, and the newly-recruited students. As expected, there was wide variation amongst this group in their knowledge, understanding, and experience of qualitative research. To address this issue, we conducted several training sessions in narrative field research techniques as well as on the ethics of research. Additionally, for an initial period, each interview was done by an enumerator, a member of the initial researcher team, or a SumArth employee. At the end of each day, we reviewed the research findings and process and organized extensive feedback sessions. Nonetheless, the quality of the collected data varied significantly.

As a final point of data quality assurance, we ensured that a senior SumArth staff member who had been involved in the design of the research from the very start, was responsible for assessing the quality of data of all narratives, before updating these into the SenseMaker database. Narratives with poor data quality were rejected on the grounds that this signified an inadequate level of trust and engagement between the researcher and the respondent. The 597 experiences collected were all subjected to this rigorous process of quality control, which was both time-consuming and expensive, impacting the overall efficiency.

The other issue we discuss is related to the non-linear, open-ended design of the signification framework, which is said to allow a reflective design, while reducing the effects of a researcher's positionality and bias. However, in our observation, compared to traditional ethnography, where researchers collect "non-solicited data—conversations as they occur, but also (observations of) activities, embodiments, movements through space, and built environments" [46], the design of a signification framework shares some characteristics with a structured interview questionnaire. However, the signification framework does enable a more active participation of the end-users in the interpretation of the qualitative data, which allows them to shape the research data and analysis.

We noted that depending on their digital literacy and experience, participant end-users can efficiently share their lived experiences, and make sense of their narratives, with or without an enumerator, in a relatively short period of time. However, when translations are required and/or when researchers or enumerators need to implement the SenseMaker, we feel that a degree of researcher bias creeps into the process. This is especially the case in remote, rural communities with prominent disparities in access, use, and literacy of digital devices.

In sum, the successful application of the SenseMaker tool is dependent on building equitable relationships and trust between the researchers and the researched [37]. In our case, we felt that regardless of the training and capacity strengthening, researcher bias and positionality do impact the design of the signification framework.

3.2. Performing Ethnography Digitally in Situations of a Digital Divide

In our experience, collecting data using the SenseMaker tool proved in some ways more challenging than traditional ethnography, due to language barriers and the digital divide which includes digital access, use, and literacy. While SenseMaker allows for language translations from English to multiple languages, including Hindi, this "standard translation" does not consider local nuances of how the language is spoken or different local dialects.

The tool's application in contexts with lower literacy has been argued to be time-consuming and labor-intensive [45]. This requires, as was in our case, the need for data collectors or enumerators. As per national statistics, Bihar's literacy rate is 61.80 percent, with male literacy at 71.20 percent and female literacy at 51.50 percent [47]. Recent reports suggest an upward trend in the literacy rate (63.8 percent); however, this is still persistently lower than the national average. This was evident in our fieldwork, where most of our participants had limited to no literacy and no digital exposure. In practice, this meant there were very few participants who could complete the signification framework questions independently. We observed that women end-user participants often felt intimidated by the framework design, and many found the prompt question confusing. In several cases, enumerators had to either repeat the question several times or prompt participants with broad follow-up questions (rather than using specific examples, to control bias). For example, open questions used might be the following: what were the challenges or benefits the farmers' or agricultural labourers encountered? Any one incident that they would like to share?

To address the challenge of women end-user participants understanding how to place their answers on the network of triads and dyads, we drew triads using real-life examples—on a board, on paper, and on the floor, and helped participants practice placing markers. More importantly, we let the enumerators conduct pilots, which were thoroughly reviewed and discussed back in the office. There have been similar experiences mentioned elsewhere, of drawing triads and dyads on the ground or paper, using pebbles as markers, and drawing examples from everyday life—a collection of activities aimed to overcome research and power dynamics [48].

Regardless of these interventions, on some occasions, enumerators needed to assist the participants by placing a marker on the signifiers and cross-checking verbally that this corresponded to the response of the participants. We learned that SenseMaker studies in Ghana and Vietnam done by the International Fund for Agricultural development (IFAD) had similar challenges [49,50]. This form of participant support was an adaption to assist participants who had low or no literacy. However, these interventions do not comply with recommended procedures, which state that the participant should place the marker themselves.

These types of challenges often lead to lengthy sessions with participant end-users, increasing the risk of gaming and bias, as well as respondent and enumerator fatigue [51]. In our experience, lengthy interviews are particularly challenging for women who carry a heavy load of agriculture and domestic care work. Occasionally, as we conducted interviews, the participants would engage in other tasks, such as transplanting rice, washing dishes, or cooking. The need for greater participant engagement when combined with a "frustrating or confused" experience with the tool's design has been linked with higher interview dropout rates with SenseMaker than with "straightforward" surveys [52].

Finally, despite our best efforts, it was challenging to maintain the privacy and individual voices of participants due to the frequent presence of crowds of neighbors. In such situations, the participant's response could be interrupted by the voices of others, including men interrupting women. This resulted in increased inhibitions and more filtered, staged responses. In one case, a woman from a marginalized caste group was frequently interrupted during the session by her husband, who said, "She would not know; why are you asking her?". In such situations, we paused the discussions and resumed these in spaces appropriate for a woman to be alone, for instance in a temple or in the fields. We had anticipated these issues during the design phase of our research and discuss them here to point out that the voices of the marginalized are often crowded out in real-world environments.

Our training of enumerators included asking them to be patient with participants who struggle to understand the SenseMaker questions and processes. This was part of our research ethics procedure. Regardless, bias, positionality, and power dynamics did persist and will have likely affected the quality and reliability of data [48].

3.3. Drawing Insights from SenseMaker Data

In this section, we turn to some of our results to examine how and to what degree this tool enabled us to meet our goals of revealing the gendered dimensions of everyday experiences of exclusions, climate vulnerabilities, and resilience among marginalized women. We also touch on how gender-power hierarchies were revealed in the context of sharing lived experiences. We argue that although SenseMaker did not reveal anything we did not already know, there was value in making those dimensions concrete in a way that validated marginalized local perspectives.

Key findings are presented in Box 1. They highlight the success in connecting dimensions such as climate impacts on productivity to gender and other social factors. They also demonstrate the interconnections and mutually reinforcing effects of such social factors. Ultimately, this vividly demonstrates why a granular understanding of the historical, social, political, economic, and cultural underpinnings of inequality is required for any effective intervention. An illustration of selected data can be found in Appendix B.

The findings we present were enabled by two characteristics of the tool. Firstly, self-interpretation is the active role given to end-user participants, who are not just sources of information as is the case in traditional research, but also interpreters of data. This process of data validation and interpretation allows for a more critical analysis of lived experiences, with the potential to shape policy from the perspective and experience of the end-user participants. Secondly, the ability to visualize and disaggregate perspectives according to different combinations meant that similarities and differences between groups could be accessed, allowing us to map the complexity of intersectional inequalities by gender, caste, and class. We would like to add here that the SenseMaker signification framework can and should possibly be combined and contrasted with data from other sources, such as interviews with stakeholders, allowing prevailing narratives to emerge alongside neglected ones.

In summary, regardless of the richness of our findings, we noted that the findings are likely shaped by hypotheses and expectations already formed due to several factors. Most of the local enumerators were SumArth personnel and members, all of whom had previously worked closely with these communities and were well-versed in the conditions and challenges of the villages, farmers, and laborers. Even the “external” research team had spent 2–3 months on the group through interviews and focus groups, building familiarity with the region, its challenges, and its narratives. Past SenseMaker projects focusing on rural development and climate adaptations, including the Triple-S Project conducted by the IRC International Water and Sanitation Centre in Ghana and Uganda [49] and the Adaptation in the Mekong Delta Program in Vietnam by International Fund for Agricultural Development (IFAD) [50], made observations similar to ours.

In future applications of SenseMaker, we believe exploring the potential for novel insights would be valuable. A productive avenue would be a longer-term use of the tool, embedded into more processes and times of the year, to reveal different insights over climatic cycles. In this case, SenseMaker was used during a single, distinct period to collect narratives over two months. A longer-term collection would have allowed a greater diversity of experiences to be collected, increased familiarity, decreased intimidation by digital technology, and allowed more unsolicited experiences to emerge, which would lead to potentially unsuspected insights. More time would have also enabled more investment in training and tailoring the method to the participants and context [48].

3.4. Digitalizing Reflective Dialogues: A Step forward or backward

In this section, we return to the questions we wanted to answer: Can ethnographic research be performed digitally? Did our application of SenseMaker allow mapping and capturing intersectional vulnerabilities to climate change impacts with diminished subjective researcher bias, i.e., did it allow “a decentering of researcher knowledge and authority” and “create more plural spaces of problem identification and interrogation?” ([17], p. 67).

Box 1. Summary of hypotheses and key findings.**Prior hypotheses and assumptions**

- The team assumed that individuals and groups facing persistent intersectional inequalities were disproportionately affected by climate change because they were excluded on multiple fronts, with marginalized women bearing the triple burden of climate change intersecting with poverty, gender norms, and their limited access to ownership of resources and services.
- Regarding stakeholders, the team expected that hierarchical and technocratic institutions that do not take intersectional inequalities into account will not be able to achieve deep structural reforms to mitigate climate change impacts.

Key findings from SenseMaker data

- Several social factors—gender, caste, class, and age—shape marginality and vulnerability: these factors must be considered in any intervention; failing to do so will result in exclusion, and gender alone is not a sufficient proxy. These factors also determine that the most marginalized women, as well as the most vulnerable, are largely excluded from empowerment initiatives, including agriculture and climate interventions.
- Women do not lead isolated lives, and their social relations with men (husbands, sons, and other male actors) are vital to their empowerment. Therefore, acting on these social relations, i.e., working with women, as well as engaging with men, is important for enabling women to emerge as entrepreneurs. Moreover, marginalization and pervasive gender norms affect men as much as they do women.
- Tertiary stakeholders—i.e., staff of government/private/civil society organizations who are at the point of contact with communities need to be equipped to understand the nature of social relations or intersecting inequalities and build technological expertise. The effectiveness of policies, actions, and finance for bringing about transformation on the ground would be enhanced if these actors' capacities were strengthened.

One of our biggest lessons was that the process of recording responses on an electronic device can result in apprehension and expectations that influence how participants communicate, and what they are willing to share. In addition, as was feared by our local partner, our long-drawn process of engagement with community members, including the digital recording of narratives, generated a lot of expectations. This happened even though, at the start of the research process, we had explained to each individual participant end-user that this was research, with no benefits attached, and informed them they could discontinue their engagement, at any time, with no explanations.

The fact that 85 percent of the narratives were coded negative by the participants, indicates that there might have been an expectation of assistance or benefits. However, we are not entirely sure whether this pattern indicates an expression of the anticipation of “something in return” to counter negative experiences, or whether this was the reality of the everyday lived experience of the impacts of climate and other challenges impacting local communities, especially the most marginalized. We are also aware that these factors are not mutually exclusive and could be co-present, influencing one another. We also wonder if this outcome was influenced by having a local partner, SumArth, whose initiatives are well known to local communities, even though the most marginalized were often not part of these initiatives.

In presenting our experience of the application of SenseMaker in this paper, we have not discussed our experiences in the application of the signification framework with institutional stakeholders. This was primarily to avoid presenting two different stories. However, we do want to add here, that in contrast to the prominently negative coding of experiences by end-user participants, we documented overtly positive stories with institutional stakeholders. This was particularly intriguing because, in earlier qualitative and unstructured “discussions” with the same actors, we had noted more reflective, negative narratives, which pointed out issues of institutional structures and cultures impacting program outreach. However, when we went back to the same participants with a digital tool, we felt that there was a strong tendency among the participants to share more positive stories, although the overall theme correspondence between the two methods is notable. Since the

signification framework does not offer space for follow-up questions, unlike in traditional ethnography, we feel that there is a need to be very vigilant in addressing bias in the design phase, and in the application of the tool.

Our learning was that any research tool, including the digital SenseMaker, is not without the possibility of bias and positionality. In other words, these issues are common in most research projects where power dynamics prevail. What we do observe here, is that despite a transdisciplinary design and approach, underlying biases do shape research processes, data, and outcomes. What matters is paying attention to these issues.

4. Discussion

The main lesson from the application of SenseMaker was that our incorporation of new digital tools and technology demanded of us that “we do more of what we have been doing, rather than less of what we were doing” in traditional processes of ethnographic research ([21], pp. 37–38). These challenges relate to the application of the SenseMaker in a particular local context, and we note that there are no specific guidelines on the why or how-to of these issues. There were four takeaways that we learned from our experience of implementing SenseMaker in a setting with limited digital access and literacy. These challenges do not come only from the tool itself, but also from the traditional rhythms of research, with defined engagements that include enumerators and a very specific mode of data collection.

The first takeaway was the need for adequate time and resources to gain insight into the research context in order to identify a relevant prompting question and subsequently, signifiers. The signification framework including the prompt question and diverse signifiers differs from traditional surveys and interview questions and understanding these requires time to fully comprehend. This includes considering how to explain the signification framework to respondents, as well as piloting the framework to assess the ease of communication between the enumerators and the respondents on the framework design and structure. Without taking the time to develop a contextually relevant signification framework and assess the ease of communication in implementing the framework, the data collected will likely be compromised. The SenseMaker design process does call for periodic training, pause, and reflection of enumerators, researchers, and field implementers of the tool. This is a standard requirement of all good participatory research processes. The point we make here is that these processes are essential to the application of SenseMaker.

Interestingly, we noted that because SenseMaker is based on abductive logic, researchers’ prior training may or may not prove useful. For instance, data collectors with a background in ethnography or qualitative methods may need to unlearn asking follow-up questions—which could be leading and or subjective and adhere to the predefined set of questions. Data collectors also need to strategize possible ways to help respondents with low literacy levels understand unfamiliar SenseMaker questions (dyads, triads, stones, and sliders). In our case, we used paper or soil to draw signifiers/or questions to illustrate using real-life examples.

The second takeaway was that the research process must intentionally plan and facilitate for data collectors to reflect on the content, language, process, and length of the signification framework during the pilot phase. During the pilot phase of the project, researchers took notes and had a reflexive session at the end of each field visit. We went a step further to invest time in the design of research methods and processes by enabling researchers and a representative group of local stakeholders to collaboratively revise the signification framework. Adhering to this process meant that the process of finalizing the framework required three months, but it ensured that critical perspectives, needs, voices, and experiences of marginalized women were taken into account.

These processes of reflecting on the signification framework resulted in us ending up with a slightly lengthier framework, despite caution in the SenseMaker training guide to avoid this. In practice, when we started the implementation process, the length of the framework coupled with other challenges related to language, literacy, and digital exposure,

led to long interviews, increasing the risk of bias because of participant and data collector fatigue. In summary, the length of the framework is a critical factor to consider, including ensuring the language of the framework aligns with the local dialects and considering the time taken in the process of translations.

The third takeaway was the importance of a diverse sample to capture multiple perspectives on a greater scale. Ideally, diversity should include multiple intersecting factors. In our case, we considered not just social identities (caste and gender), but also work and income, making sampling a key concern. In our selection of the sample size, we considered the power dynamics of gender, caste, and income. Our sample gender ratio was 60:40 (women: men). We had more interviews with women from Scheduled Castes, Scheduled Tribes, and Extremely Backward Caste (226 total respondents), most of whom are landless and earn a living either by sharecropping or agricultural labor. We employed both random and snowball techniques for the selection of our respondents. In some villages, the informants appointed by SumArth assisted us in reaching out to the respondents, but the informants' own positionalities affected that process. This required additional awareness on our part to reach out to marginalized caste categories and capture their voices. Adopting an inclusive approach to the community's diversity enabled us to examine the intersections of the power dynamics and deconstruct the underlying inequalities that make the marginalized more vulnerable to climate change.

Our final takeaway was the need to assemble a team of both male and female data collectors, based on the requirements of the study, prior to data collection. Some women participants may not feel comfortable being interviewed by a male enumerator due to socio-cultural parameters which can influence their stories. For our project, although we had both male and female data collectors, there was a gender imbalance with three female (one was working part-time) and 12 male enumerators. In Bankey Bazar, a remote rural block in the Gaya district, one of our study locations, male enumerators collected all the stories. The reason given was the difficulty or rather the reluctance to organize accommodation facilities for women in the location. This hints at larger structural issues of the challenges faced by female researchers, that remain largely unaddressed in most research contexts.

In summary, we make a radical suggestion that if SenseMaker is to retain its promise of an ethnographic digital tool—designed for transdisciplinarity—then it needs to embed the design and approach in recognition of normative power dynamics in research processes. We would like to see digital tools like SenseMaker embedded in practices of research that absorb some rhythms of the process of conventional “deep hanging out”. For instance, embedding processes of participant observation, where stories may be told more naturally due to a longer period of familiarity between enumerators and respondents, as well as the tool. This might allow more space for diversity in narratives. Simultaneously, this would allow the research to broaden its reach and scale while still challenging traditional ethnography's subjective biases. Or, even better, it would encourage community-led implementations of the tool as opposed to researcher-led ones. In reality, it might also present some difficulties due to a lack of skills (research or interviewing) that would necessitate training investments.

5. Conclusions and Solutions to Explore

As the digital landscape continues to evolve, it is both necessary and important to experiment with new research tools that might allow researchers to gather a better understanding of human behavior. Digital tools can provide us with valuable insights into how individuals think, feel, and act based on their social, economic, and political context. Collecting and analyzing digital data through SenseMaker provides useful insights into the complexities of human behavior that cannot always be gathered with the same breadth or speed through conventional ethnography. By using this technological tool, we were able to collect rich, real-time, large-scale data from a wide variety of participants, providing a “full” picture of the intersectional inequalities and challenges faced by these communities in Gaya, Bihar.

The goal of this paper was to discuss the methodological implications of the SenseMaker, rather than focus on its research outcomes. We reflected here on our experience in using this digital tool, and the paper opens up questions about methodology, subjectivity, and positionality that seem to apply in both traditional and digital ethnography. We approached this discussion through the framework of transdisciplinarity, which allowed us to consider how knowledge is co-produced with the researched during the research process itself. In doing so, we recognize the diversity of knowledge and experience that ethnographic research can encompass when it directly addresses power and positionality. While SenseMaker offers more interactive formats of data analysis and presentation, it may not always offer an alternative to deep hanging out. Two issues are particularly key in relation to the application of this tool: digital literacy and power hierarchies. Firstly, in economically marginalized communities where digital use and literacy is low, there are limits on the scope of the SenseMaker application, and there are, potentially, risks of higher data being susceptible to bias and misinterpretation.

Secondly, regardless of the methodology, power hierarchies between the researchers, and between researchers and the local communities persist and compromise the research process. Regular evaluation of these processes is as important as assessing the application of the framework and the data collected. While we recommend establishing a local base, developing local networks, and allowing local researchers to be actively involved in the research process from the start, it is important to consider that diversity and power dynamics exist within these local categories as well. This means more consideration must be taken as to how local researchers are chosen, ensuring that they come from diverse backgrounds in terms of caste, gender, work, and income—and providing space and scope for reflection on processes of teamwork. The development of the signification framework should ideally happen, after [local] researchers have spent considerable time in the local communities, establishing rapport and trust with the community members, and understanding local contexts.

SenseMaker is a powerful tool that can compile complex and large-scale data from a wide variety of participants, allowing for the possibility of self-interpretation from the participants themselves and the ability to effectively visualize and disaggregate the data. Still, researchers must carefully and creatively consider how to include the voices of the marginalized in the research design before applying the digital tool. Just as in traditional ethnographic methods, digital tools like SenseMaker are still designed by the researchers and therefore, the signification frameworks must take into consideration existing power and knowledge hierarchies. In summary, all forms of research methods, including both traditional and digital ethnography, are susceptible to research subjectivity and bias.

Author Contributions: Conceptualization, D.J., A.P., M.B. and U.U.; Formal Analysis, M.B., D.J. and U.U.; Investigation, D.J., M.B. and U.U.; Data Curation, U.U. and M.B.; Writing—Original Draft Preparation, M.B., D.J. and A.P.; Writing—Review & Editing, A.P., D.J., U.U. and A.S.; Visualization, U.U.; Supervision, D.J. and A.P.; Funding Acquisition, D.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research was carried out under the CGIAR GENDER Impact Platform (C-0022-PLAT-01 Gender), which is grateful for the support of CGIAR Trust Fund contributors: www.cgiar.org/funders (accessed on 10 February 2023).

Institutional Review Board Statement: This project received its exemption certification from the Institutional Review Board (IRB-IWMI) on 30 August 2021. As quoted, “Following an expedited review of this project submission, the SenseMaker methodology and the practices adopted by the team to protect the targeted vulnerable project participants, it has been determined that the project qualifies for minimal risk exemption, aligned with Section 45 CFR 46.101(b) of the US Federal Policy for the Protection of Human Subjects, Exempt Category: (2) (ii) Educational tests, surveys, interviews, or observation (low risk) and Exempt Category: (4) Secondary data research”.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: This research was made possible through funding by the CGIAR GENDER Impact Platform METHODS Module. We are extremely grateful to our collaborating partners who include Prabhat Kumar and Mayank Jain, the co-founders of SumArth and the relevant staff—enumerators; and Anna Panagiotou from Cynefin Co. We also would like to thank the following IWMI consultants for their research support: Meghajit Shijagurumayum, Arunima Hakhu, Runny Tomar, Sahara Basnet, Omkar Mishra, and Sahil Verma.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A. Sample Signifiers for the SenseMaker Signification Framework for Participant End-Users

This appendix presents an overview of the SenseMaker signification framework as well as a small sample of the signifiers used in the signification framework for participant end-users. The purpose of these signifiers is to aid participants in making sense of their experiences by indicating how they relate to the series of ideas. The selected signifiers are intended to demonstrate the diversity of domains that the framework covers. The following description of the signifiers is referenced from the technical note [23] authored by Van der Merwe et. al. (2019).

SenseMaker is an innovative qualitative research method that emphasizes the use of micronarratives derived from participants' personal experiences. Unlike standard immersive interviews typically conducted by researchers, "SenseMaker collects micronarratives through community facilitators", promoting a distributed ethnographic methodology that empowers participants to interpret their own narratives [23]. This process of self-signification imbues the micronarratives of participants with personal meaning and significance, thereby eliminating the need for ethnographic classification and expert reinterpretation.

SenseMaker is a hybrid methodology that combines qualitative and quantitative data [53]. The SenseMaker instrument includes research questions as indicators that anchor the "spatial placement of micronarratives". A signification framework is used to extract linked meanings from participant narratives, which comprises predetermined questions that "guide the process, elicit micronarratives, and explicate interpretations". Signification occurs when participants respond to signifier questions about their micronarratives and "numerical coordinates are associated with the micronarrative within the signification framework" [23].

SenseMaker provides a connected, parallel-evaluable collection of qualitative and quantitative data that can reveal cognitive change patterns. The set of signifiers can be plotted in SenseMaker to identify and extract shifts in cognitive patterns, revealing a "mathematical map of the social landscape". The signification framework serves as a starting point for examining the "underlying relationships, norms, and dynamics of a social system". This innovative method facilitates large-scale investigations that reduce researcher bias and enable more objective analyses [23,54].

The SenseMaker framework consists of 5 major components:

- The narrative question
- Dyads
- Triads
- Multiple Choice Questions
- Stones (We decided not to use this signifier in our research because it would have made the framework overly lengthy).

Appendix A.1. Narrative Question

The process of collecting micronarratives begins with an open-ended question inviting participants to share their observations or experiences. For the narratives to be effective, they must be told from the respondent's point of view, and both positive and negative experiences must be prompted, either subtly or explicitly. The use of platitudes as research stimuli are avoided because they do not encourage introspection or meaningful insights [23].

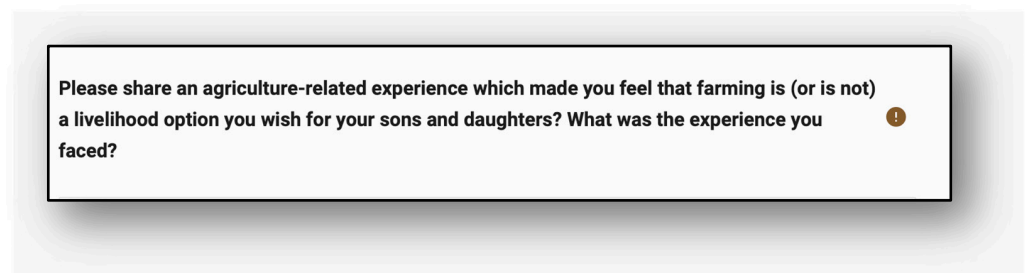


Figure A1. Example of the “Narrative” Section.

Appendix A.2. Dyads

To assess the potency of an “idea, quality, belief, or outcome on a scale between two opposing extremes”, the dyad widget is used [23]. This widget's slider gauges the relative “strength of the concept”, ranging from “neutral to positive or negative”, depending on the position of the slider. In the case of bipolar concepts, it is recommended to use a dyad based on “Aristotle's golden mean”, ref. [23] which accentuates the differences between the extremes, varying from “extreme excess to deficiency”. After participants choose a spot on the slider that reflects their viewpoint, the tool determines the percentage allocation to the two opposing variables, indicating their relative strengths. Dyads can help researchers explore underlying assumptions, test hypotheses, and evaluate the potential of modifiers [23].

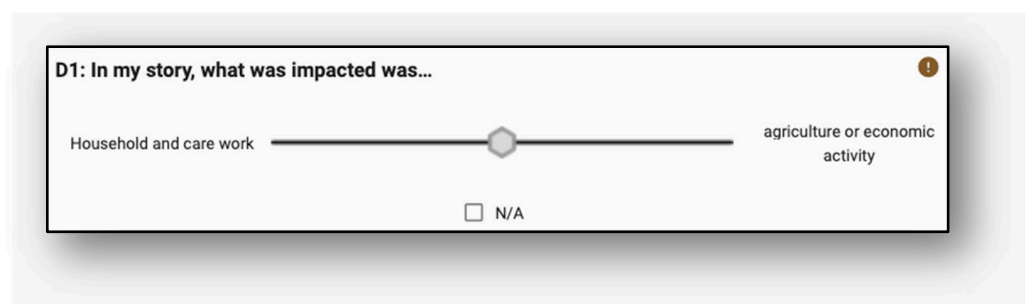


Figure A2. Example of the “Dyads” Section.

Appendix A.3. Triads

A triad widget is a tool that can help explore the significance of three concepts in relation to one another [23]. This instrument takes the form of a triangle and can be used to identify subtle nuances and underlying systems, as well as analyze tradeoffs. Each corner of the triangle represents one of the three concepts. Participants are asked to place a dot within the triangle to “indicate the intensity or influence” of each idea in relation to their story. The numerical outputs for the dot's position in the triad “always add up to 100, providing insight into the relative weight of each of the three specified corners” [23].

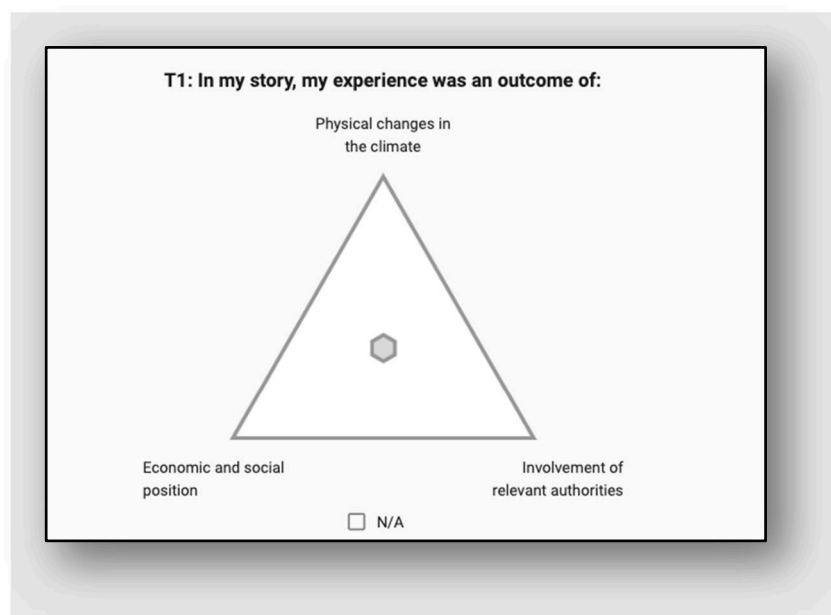


Figure A3. Example of the “Triads” Section.

Appendix A.4. Multiple Choice Questions

Multiple-choice questions are an effective tool for gathering “participant demographics and clarifying specific aspects of a narrative”. When developing these questions, it is important to consider various categories that can aid in filtering findings during analysis, such as “age, gender, location, and other related aspects associated with the story” [23]. Including relevant and appropriate multiple-choice options can help researchers better understand and analyze the data they collect.

Figure A4. Example of the “Multiple Choice Questions” Section.

Appendix B. Background to Visualizations

This selection of data is not intended to be complete or exhaustive, but merely provide an illustration of some of the supporting evidence.

“Triads” contain a series of dots that correspond to the responses received from study participants. When answering the question, the participant had to consider the balance/tension of the three elements described on each corner of the triangle in relation to the experience they shared. They then marked their responses accordingly by dragging a marker to the position on the shape that best reflects their story.

When viewing the resultant graphs, the aggregate responses can be seen as a pattern of dots, where the greater the concentration, the more people identified that area as showing the correct mix of elements in their story. To help the viewer make more accurate sense of the visuals, a network of different areas in the triangle is defined, and percentages indicate the relative size of the groups of stories in that area.

By selecting any dot, or group of dots, on the resultant graph, the original stories can be recalled and read to gain deeper understanding of the context behind the response.

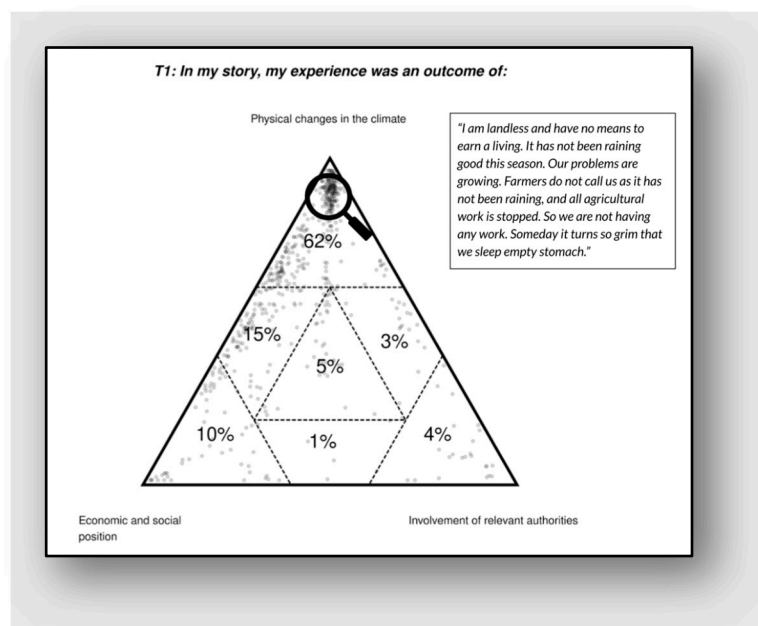


Figure A5. The results from the Triad analysis depicted in Figure A3 show the way 597 participant end-users identified or described what their experience was an outcome of—in other words, what affected it. Specifically, the majority of end-users attributed their experiences to physical changes in the climate. Each dot in the figure represents a narrative, and one such narrative is shown as an example. The percentages indicate the number of responses falling within each area of the triad, providing a numerical expression of the concentration of narratives placed there.

References

- O'Neill, S.; Hulme, M.; Turnpenny, J.; Screen, J. Disciplines, Geography, and Gender in the Framing of Climate Change. *Bull. Am. Meteorol. Soc.* **2010**, *91*, 997–1002. [CrossRef]
- Tschakert, P.; Tutu, R.; Alcaro, A. Embodied Experiences of Environmental and Climatic Changes in Landscapes of Everyday Life in Ghana. *Emot. Space Soc.* **2013**, *7*, 13–25. [CrossRef]
- Waseem, M.; Khurshid, T.; Abbas, A.; Ahmad, I.; Javed, Z. Impact of Meteorological Drought on Agriculture Production at Different Scales in Punjab, Pakistan. *J. Water Clim. Chang.* **2021**, *13*, 113–124. [CrossRef]
- Aggarwal, P.; Jarvis, A.; Campbell, B.; Zougmore, R.; Khatri-Chhetri, A.; Vermeulen, S.; Loboguerrero, A.M.; Sebastian, L.; Kinyangi, J.; Bonilla-Findji, O.; et al. The Climate-Smart Village Approach: Framework of an Integrative Strategy for Scaling up Adaptation Options in Agriculture. *Ecol. Soc.* **2018**, *23*, 14. [CrossRef]
- IPCC. Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems. 2019. Available online: <https://www.ipcc.ch/site/assets/uploads/sites/4/2021/07/210714-IPCCJ7230-SRCCL-Complete-BOOK-HRES.pdf> (accessed on 15 December 2022).
- Hans, A.; Rao, N.; Prakash, A.; Patel, A. *Engendering Climate Change Learnings from South Asia*; Routledge: Oxfordshire, UK, 2021.
- Huyer, S. Closing the Gender Gap in Agriculture. *Gend. Technol. Dev.* **2016**, *20*, 105–116. [CrossRef]
- De Souza, K.; Kituyi, E.; Harvey, B.; Leone, M.; Murali, K.S.; Ford, J.D. Vulnerability to Climate Change in Three Hot Spots in Africa and Asia: Key Issues for Policy-Relevant Adaptation and Resilience-Building Research. *Reg. Environ. Chang.* **2015**, *15*, 747–753. [CrossRef]
- Geertz, C. Deep Hanging Out | Clifford Geertz. Available online: <https://www.nybooks.com/articles/1998/10/22/deep-hanging-out/> (accessed on 13 February 2023).
- Magnat, V. Conducting Embodied Research at the Intersection of Performance Studies, Experimental Ethnography and Indigenous Methodologies. *Anthropologica* **2011**, *53*, 213–227.
- Markham, A. *Doing Digital Ethnography in the Digital Age*; RMIT University: Singapore, 2020. [CrossRef]
- Cleland, J.; MacLeod, A. Disruption in the Space-Time Continuum: Why Digital Ethnography Matters. *Adv. Health Sci. Educ. Theory Pract.* **2022**, *27*, 877–892. [CrossRef]
- Dicks, B.; Mason, B.; Coffey, A.; Atkinson, P. *Qualitative Research and Hypermedia: Ethnography for the Digital Age*; SAGE: New York, NY, USA, 2005.

14. Murthy, D. Digital Ethnography: An Examination of the Use of New Technologies for Social Research. *Sociology* **2008**, *42*, 837–855. [CrossRef]
15. Hine, C. *Virtual Ethnography*; SAGE: London, UK; Thousand Oaks, CA, USA, 2000.
16. Herring, S.C. Computer-Mediated Discourse Analysis: An Approach to Researching Online Behavior. In *Designing For Virtual Communities in the Service Of Learning*; Learning in doing; Cambridge University Press: New York, NY, USA, 2004; pp. 338–376. [CrossRef]
17. Underberg, N.M.; Zorn, E. *Digital Ethnography: Anthropology, Narrative, and New Media*; University of Texas Press: Austin, TX, USA, 2013.
18. Van Dijk, J.A.G.M. *The Deepening Divide: Inequality in the Information Society*; Taylor & Francis: Abingdon, UK, 2005; p. 240. [CrossRef]
19. Aguiar, C.M.; de Vasconcelos, J.P. What Is the Digital Divide? Internet Society: Reston, VA, USA. Available online: <https://www.internetsociety.org/blog/2022/03/what-is-the-digital-divide/> (accessed on 13 February 2023).
20. Coleman, S.; Normann, E. *New Media and Social Inclusion*; Hansard Society: London, UK, 2000.
21. Kelly, W.W. Digital Technologies, Virtual Communities, Electronic Fieldwork: The Slow Social Science Adapts to High-Tech Japan. In *eFieldnotes: The Makings of Anthropology in the Digital World*; University of Pennsylvania Press: Philadelphia, PA, USA, 2016.
22. Bailey, C.A. *A Guide to Qualitative Field Research*, 2nd ed.; Bailey, C.A., Ed.; Pine Forge: Thousand Oaks, CA, USA, 2007.
23. Van der Merwe, S.E.; Biggs, R.; Preiser, R.; Cunningham, C.; Snowden, D.J.; O'Brien, K.; Jenal, M.; Vosloo, M.; Blignaut, S.; Goh, Z. Making Sense of Complexity: Using SenseMaker as a Research Tool. *Systems* **2019**, *7*, 25. [CrossRef]
24. Lønsmann, D. Negotiating Positionality in Ethnographic Investigations of Workplace Settings: Student, Consultant or Confidante? In *The Ins and Outs of Business and Professional Discourse Research: Reflections on Interacting with the Workplace*; Alessi, G.M., Jacobs, G., Eds.; Communicating in Professions and Organizations; Palgrave Macmillan UK: London, UK, 2016; pp. 13–36. [CrossRef]
25. Bihar State Action Plan on Climate Change 'Building Resilience through Development'; Government of Bihar: Patna, India. 2015. Available online: <http://moef.gov.in/wp-content/uploads/2017/08/Bihar-State-Action-Plan-on-Climate-Change-2.pdf> (accessed on 2 January 2023).
26. Mohanty, R.N. Chronic Poverty and Social Conflict in Bihar. *SSRN Electron. J.* **2005**, 1–24. [CrossRef]
27. Agarwal, T.; Goel, P.A.; Gartaula, H.; Rai, M.; Bijarniya, D.; Rahut, D.B.; Jat, M.L. Gendered impacts of climate-smart agriculture on household food security and labor migration: Insights from Bihar, India. *Int. J. Clim. Chang. Strateg. Manag.* **2022**, *14*, 1–19. [CrossRef]
28. Aheyyar, M.; de Silva, S.; Senaratna-Sellamuttu, S.; Arulingam, I. Unpacking Barriers to Socially Inclusive Weather Index Insurance: Towards a Framework for Inclusion. *Water* **2019**, *11*, 2235. [CrossRef]
29. United Nations. *World Social Report 2020: Inequality in a Rapidly Changing World*; UN: New York, NY, USA, 2020. [CrossRef]
30. Kroll-Zeldin, O. Colonialism. 2016. Available online: <https://www.oxfordbibliographies.com/display/document/obo-9780199766567/obo-9780199766567-0139.xml> (accessed on 15 February 2023).
31. Lewis, D. Anthropology and Colonialism. *Curr. Anthropol.* **1973**, *14*, 581–602. [CrossRef]
32. Merriam, S.B.; Johnson-Bailey, J.; Lee, M.-Y.; Kee, Y.; Ntseane, G.; Muhamad, M. Power and Positionality: Negotiating Insider/Outsider Status within and across Cultures. *Int. J. Lifelong Educ.* **2001**, *20*, 405–416. [CrossRef]
33. Hesjedal, M.B.; Åm, H. Making Sense of Transdisciplinarity: Interpreting Science Policy in a Biotechnology Centre. *Sci. Public Policy* **2023**, *50*, 219–229. [CrossRef]
34. Snowden, D. Appendix 2: Narrative Research. 2010. Available online: https://narrate.typepad.com/100816-narrative-research_snowden-final.pdf (accessed on 16 December 2022).
35. Wakeford, T.; Rodriguez, J. *Participatory Action Research: Towards a More Fruitful Knowledge*; University of Exeter: Exeter, UK, 2019.
36. Seidl, R.; Brand, F.S.; Stauffacher, M.; Krütli, P.; Le, Q.B.; Spörri, A.; Meylan, G.; Moser, C.; González, M.B.; Scholz, R.W. Science with Society in the Anthropocene. *AMBIO* **2013**, *42*, 5–12. [CrossRef]
37. Ziervogel, G.; Enqvist, J.; Metelerkamp, L.; van Breda, J. Supporting Transformative Climate Adaptation: Community-Level Capacity Building and Knowledge Co-Creation in South Africa. *Clim. Policy* **2022**, *22*, 607–622. [CrossRef]
38. Toyama, K. *Geek Heresy: Rescuing Social Change from the Cult of Technology*; PublicAffairs: New York, NY, USA, 2015.
39. D'Ignazio, C.; Klein, L.F. *Data Feminism*; The MIT Press: Cambridge, MA, USA, 2020.
40. Georgalakis, J. Shaping Policy with Evidence (Online); Institute of Development Studies: Falmer, UK. Available online: <https://www.ids.ac.uk/specialist-short-courses/shaping-policy-with-evidence/> (accessed on 14 February 2023).
41. Rigolot, C. Transdisciplinarity as a Discipline and a Way of Being: Complementarities and Creative Tensions. *Humanit. Soc. Sci. Commun.* **2020**, *7*, 7. [CrossRef]
42. Pike, K.L. Etic and Emic Standpoints for the Description of Behavior. In *Language in Relation to a Unified Theory of the Structure of Human Behavior*, 2nd ed.; Mouton & Co.: The Hague, The Netherlands, 1967; pp. 37–72. [CrossRef]
43. Young, J. On Insiders (Emic) and Outsiders (Etic): Views of Self, and Othering. *Syst. Pract. Action Res.* **2005**, *18*, 151–162. [CrossRef]
44. Milne, K.M.G. Can Sense-Making Tools Inform Adaptation Policy? A Practitioner's Perspective. *Ecol. Soc.* **2015**, *20*, 66. [CrossRef]
45. van Breda, J.; Swilling, M. The Guiding Logics and Principles for Designing Emergent Transdisciplinary Research Processes: Learning Experiences and Reflections from a Transdisciplinary Urban Case Study in Enkanini Informal Settlement, South Africa. *Sustain. Sci.* **2019**, *14*, 823–841. [CrossRef]

46. Lincoln, Y. Engaging Sympathies: Relationships between Action Research and Social Constructivism. In *The SAGE Handbook of Action Research: Participative Inquiry and Practice*; SAGE Publications: London, UK; Thousand Oaks, CA, USA, 2008; pp. 124–132.
47. Bihar Population Census 2011, Bihar Religion, Literacy, Sex Ratio—Census India. Available online: <https://www.censusindia.co.in/states/bihar> (accessed on 14 February 2023).
48. Bartels, S.A.; Michael, S.; Vahedi, L.; Collier, A.; Kelly, J.; Davison, C.; Scott, J.; Parmar, P.; Geara, P. SenseMaker® as a Monitoring and Evaluation Tool to Provide New Insights on Gender-Based Violence Programs and Services in Lebanon. *Eval. Program Plann.* **2019**, *77*, 101715. [[CrossRef](#)] [[PubMed](#)]
49. Hemelrijck, A.V. *Methodological Reflections Following the Second PIALA Pilot in Ghana*; IDS: Falmer, UK, 2016.
50. Hemelrijck, A.V.; Goh, Z. *Methodological Reflections on the Use of SenseMaker® for Impact M&E of Adaptation in the Mekong Delta (AMD)*; IFAD: Roma, Italy, 2015.
51. Boellstorff, T. Rethinking Digital Anthropology. In *Digital Ethnography*; Bloomsberry Academic: London, UK, 2013.
52. Fisher, E.; Hellin, J.; Greatrex, H.; Jensen, N. Index Insurance and Climate Risk Management: Addressing Social Equity. *Dev. Policy Rev.* **2019**, *37*, 581–602. [[CrossRef](#)]
53. Wamsler, C.; Osberg, G.; Panagiotou, A.; Smith, B.; Stanbridge, P.; Osika, W.; Mundaca, L. Meaning-making in a context of climate change: Supporting agency and political engagement. *Clim. Policy* **2022**, 1–16. [[CrossRef](#)]
54. The Cynefin Centre for Applied Complexity. SenseMaker®. Available online: <https://thecynefin.co/about-sensemaker/> (accessed on 27 March 2023).

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.