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Evaluating behavioural changes for climate adaptation planning

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Most climate adaptation plans expect stakeholders to change their behavior as part of building resilience. Given its long-term and complex nature, monitoring and evaluation is a key requisite for climate adaptation planning. So far, behavioral aspects have received only limited attention in the evaluation approaches for climate adaptation planning. This article proposes a theory-based evaluation approach based on the theory of planned behavior, for the evaluation of climate adaptation. A local climate adaptation programme for watershed development in rural India provides an illustrative case for this approach. For this case, the approach helped to uncover important factors that influence behavioral intentions, which were different for different groups in the farming community. Additionally, it helped to put behavioral change in a longer-term perspective. The illustrative case also suggests certain improvements for evaluations based on the theory of planned behavior.

Keywords: adaptation planning; climate adaptation; theory of planned behavior; evaluation; watershed development; India

1. Introduction

Planners and policy makers have been confronted with the impacts of global climate change on the environment and society for more than two decades (IPCC 2001, Parry *et al*. 2007; Adger *et al*. 2003, 2007). In response, climate change adaptation plans and programs of action have been developed to help societies to cope with the effects of climate change (Adger *et al*. 2003; Kiem and Austin 2013; Fedele *et al*. 2019; Woodruff and Regan 2019). As adaptation is a long-term and complex process, climate adaptation plans cannot be expected to provide perfect blueprints that can be implemented without further learning and modification. A sound policy learning system, based on a meaningful monitoring and evaluation framework, is required to support sustained adaptations, over multiple iterations of planning and implementation (Olivier, Leiter, and Linke 2012; Mimura *et al*. 2014; Somda *et al*. 2017).

Behavioral change is a key aspect of climate change adaptation. Cognitive and affective factors, as well as social and cultural factors, are known to motivate or inhibit

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adaptation behavior (Adger *et al*. 2007; Heyd and Brooks 2009; O'Brien 2009; Van Valkengoed and Steg 2019). An effective adaptation depends on whether the people consider the risk of climate change sufficiently serious and if they think that they are capable of effective adaptation action (Grothmann and Patt 2005; Truelove, Carrico, and Thabrew 2015; Van Valkengoed and Steg 2019). Thus, understanding behavioral changes and community perceptions is needed to support effective implementation of climate change plans (Gifford, Kormos, and McIntyre 2011; Tesfahunegn 2019; Seara, Clay, and Colburn 2016; Di Falco and Sharma-Khushal 2019).

Attempts to capture behavioral changes as part of a systematic monitoring and evaluation are increasing, but to date are still relatively limited (Flanagan and Tanner 2016; Somda *et al*. 2017). It thus becomes important to develop evaluation methods that can be used by planners and policy makers to address these behavioral dimensions in climate change adaptation plans. The question addressed in this article is: How to include behavioral changes in the evaluation of climate adaptation plans?

This article takes stock of current approaches to evaluate behavioral aspects in climate change adaptation interventions and, based on this, proposes a behavioral change evaluation approach. This approach combines theories on behavioral change with a theory-based evaluation design. The article then illustrates this approach for the evaluation of a climate change plan in India based on the behavioral change in beneficiaries. We discuss the results and end with some conclusions for future incorporations of behavioral change as part of the evaluation of climate change adaptation plans.

2. Evaluating behavioural change for climate change adaptation

2.1. Evaluation and climate change adaptation

Evaluation has developed as a field that helps to provide an evidence-based assessment of the "merit and worth" of programmes and policies (Patton 2011). Evaluation of climate change plans can help to better understand the (partial) effectiveness of the plan (Bours, McGinn, and Pringle 2013; UNFCCC 2011). In addition, it helps to assess the progress of the complex challenges the stakeholders are facing (Uitto, Puri, and van den Berg 2017) and to generate knowledge to be used to increase the adaptability of communities (Denton 2009). This means that, in addition to assessing effectiveness, another key objective for evaluation of climate adaptation, is to support learning and adjustment, based on insights into why or how plans could be (in)effective.

Evaluations that seek to uncover why and how impacts come about, are known as theory-based evaluations (Weiss 1997) or theory-driven evaluations (Chen and Rossi 1983). Theory-based evaluations describe the set of causal assumptions that represent our theory of why and how an initiative is expected to work (Weiss 1997; Chen and Rossi 1983). In many cases, these causal assumptions are ordered following a predefined logic of inputs-outputs-outcomes-impacts (see for instance Villanueva 2011). Such a theory of change approach is also considered to be suited for climate change adaptation evaluations (Uitto, Puri, and van den Berg 2017).

2.2. Evaluations of behavioural change in climate change adaptation

As noted in the introduction, behavioral change is a key component in climate change adaptation. This means that these behavioral change aspects should also be included in the evaluations of adaptation plans.

Early reviews by Villanueva (2011) and Bours, McGinn, and Pringle (2013) concluded that the conventional evaluation methods are not well suited to understand the soft aspects of adaptation such as behavioral change. More recent volumes on sustainability and climate change evaluation show that the gap in behavioral change evaluations has not yet been filled. A book on evaluating climate change action by Uitto, Puri, and van den Berg (2017) has only one chapter – out of eighteen – discussing behavioral change evaluation (Somda *et al*. 2017). A volume on sustainability evaluation edited by Julnes (2019) does not address the evaluation of behavioral change in any particular detail at all. This means that good evaluation approaches that shed light on the human behavior aspect of climate change (adaptation and mitigation), are still underdeveloped.

Although limited, some publications discuss methods to evaluate behavioral change in adaptation plans. Villanueva (2011) discusses outcome mapping as an evaluation method that focuses on behavioral change. This approach offers a structured process to identify worthwhile outcomes, including behavioral changes, in an open and participatory approach (Earl, Carden, and Smutylo 2001). Somda *et al*. (2017) describe an approach to monitor and evaluate behavioral change as part of climate change adaptation strategies in West Africa. The study uses the Most Significant Change evaluation technique (Dart and Davies 2003) for data collection combined with the theory of planned behavior (Ajzen 1991) for the interpretation of evaluation results. Both these approaches, fall well within the remit of theory-based evaluations, but in both cases, it is not clear how they build on any further unpacking of processes of behavioral change.

2.3. Current knowledge on climate adaptation behaviour, for evaluations

The limited number of publications on the evaluation of behavioral change in climate change adaptation, raises the question whether scientific theories on behavioral change and climate change adaptation can be used to support the development of theory-based evaluations.

Gifford, Kormos, and McIntyre (2011) reviewed the behavioral dimensions of climate change adaptation, stating that the most influential theories in this field are the theory of planned behavior (Ajzen 1991; 2011) and value-belief-norm theory (Stern *et al*. 1999) – which is an outgrowth of the earlier norm-activation-model (NAM), developed by Schwartz (1977). A recent example is Di Falco and Sharma-Khushal (2019), who used the theory of planned behavior to study community investment decisions in climate change adaptation actions. Although other conceptual models have been developed and applied, such as protection motivation theory (PMT) (Grothmann and Patt 2005; Truelove, Carrico, and Thabrew 2015), most of these are more complicated and have found less widespread uptake for climate change adaption (Gifford, Kormos, and McIntyre 2011).

Studies of behavioral change in climate change adaptation build on studies on pro-environmental behavior more generally. In this field, the same two streams of theories (theory of planned behavior and value-belief-norm) are dominant, according to a meta-analysis of the determinants of pro-environmental behavior by Bamberg and Möser (2007). For instance, Han (2015) reports a combined use of the theory of planned behavior and value-belief-norm theory to study pro-environmental behavior among travelers. De Leeuw *et al*. (2015) use the theory of planned behavior to study pro-environmental behavior among high-school students.

Even if there are different theories available to understand adaptation behavior, no single theory captures the full richness and dynamics of behavioral change. Farmer

adaptation decision-making, for instance, is far more complex than can be captured by any particular theoretical model (Singh, Dorward, and Osbahr 2016). Similarly, De Coninck *et al*. (2018), in their IPPC chapter, do not focus on theories, but discuss different factors that influence adaptation behavior. The focus on the two dimensions of (1) ability, based among others on income and knowledge, experience and socially constructed notions of risk, along with (2) motivations based on factors such as values, ideologies and worldviews (De Coninck *et al*. 2018, 364–365). Van Valkengoed and Steg (2019) also review different factors in a systematic meta-analysis. They include factors found in different theoretical frameworks on environmental and risk-related behavior. Their results suggest four factors that are most influential: self-efficacy (perceived ability to take action), negative affect (reducing unpleasant state of mind), outcome efficacy (perceived effectiveness of action), and descriptive norms (perceptions of others engaging in adaption activities).

This suggests at least two avenues for the development of a theory-based evaluation approach. One could be to develop a more encompassing framework that offers categorized checklists for all the different factors that can influence behavioral change. This has been done for some other fields, such as water supply and sanitation (Dreibelbis *et al*. 2013) or development (Flanagan and Tanner 2016). A second avenue would be to use a relatively simple conceptual framework based on behavioral theories, which lends itself well for combination with a theory-of-change framework. This would fit relatively well with the approaches for behavioral change evaluations described by Villanueva (2011) and Somda *et al*. (2017).

3. A framework for the evaluation of behavioural change in climate change adaptation

3.1. A Theory-Based evaluation of behavioural change

For a practical theory-based evaluation framework, we need to tradeoff scientific completeness for practical usability. Using a behavior theory as a basis is leaner on the concepts and relations included in an evaluation framework, which can then be tailored to context-specific events and observations. At the same time, it is clear that we cannot expect any theory to capture the wide range of factors that influences adaptation behavior. An elaborate framework that contains this full range of factors, levels, scales and nested systems, may become very "heavy" and quite difficult or inefficient to apply in a range of contexts, by a range of users.

In this tradeoff, we opt for a first framework that remains aligned with the current practice in climate change evaluations of behavioral changes, to use a relatively simple but theory-based approach. For this, we consider the theory of planned behavior and the value-belief-norm theory to be the main candidates. These two theories offer relatively simple and clear models that have been scrutinized for their predictive capacity when it comes to behavioral change (Ajzen 2011; Gifford, Kormos, and McIntyre 2011).

The theory of planned behavior encompasses most of the required factors to explain behavioral change, including the four influential factors from the recent meta-analysis by Van Valkengoed and Steg (2019). The value-belief-norm theory puts more emphasis on these personal values, norms and beliefs. This is most suitably used when attitude is the key determinant of behavior, which is typically the case if behavioral change is socially motivated and requires a limited effort or low-cost (Bamberg and Möser 2007; Steg and Vlek 2009). In our evaluation framework, we incorporate the

theory of planned behavior, as we also need to consider behavioral changes for adaptation beyond the 'easy gains'. However, we note that options to expand the basis are available if deemed useful in the value-belief-norm theory and various recent works cited above.

3.1.1. Limitations of the theory of planned behaviour as a basis for the framework

It is, however, important to acknowledge the limits of the theory of planned behavior. Theory of planned behavior is mostly associated with *planned* behavior, following from deliberate and reasoned decisions to act. However, adaptation behavior is also guided (or constrained) by intuitive, automatic decisions, routines and similar *habitual* behaviors (Clayton *et al*. 2015; Steg and Vlek 2009). Human behavior does not always follow rational decision pathways (Kahneman 2011), especially not under uncertainty (Tversky and Kahneman 1974).

As noted by Swim *et al*. (2011), the human dimension of climate change adaptation encompasses more than the behavioral aspects that are commonly covered in psychology. The theory of planned behavior, as a psychological theory, acknowledges the relevance of context factors that influence individual motivations, but leaves them out of its main focus. It does not include an analysis of sociological interactions between individuals, within existing institutional settings and cultural norms, except indirectly, via their manifestation as part of a resulting individual perception. These various factors and the interactions within these nested social systems and between social and physical systems, will result in a system with feedback loops, threshold effects and similar complex dynamics. These are not well captured in the linear model offered by the theory of planned behavior. These processes, beyond the level of the individual, are of course important to understand climate change adaptation and behavioral change (see e.g. Feola *et al*. 2015; Biesbroek *et al*. 2015)

3.2. The theory of planned behaviour as basis for evaluation

The theory of planned behavior advocates that human action is influenced by three major factors (Ajzen 1991). It builds on an earlier theory of reasoned action, but adds the notion of perceived behavioral control to this. It captures the notion that "behavioral achievement depends jointly on motivation (intention) and ability (behavioral control)" (Ajzen 1991, 182). However, it focuses not on *actual* behavioral control, which is often also very difficult to determine, but introduces the notion of *perceived* behavioral control. This is used as a substitute for actual behavioral control but also as a psychological factor that co-determines intentions. Intentions are thus captured by individual attitudes, socially-informed subjective norms and perceived behavioral control (Ajzen 1991). Thus, the three key elements to be included in a theory-based evaluation of behavioral change, based on the theory of planned behavior, are:

1. Attitude: Attitude is the factor of behavior that is attached to an individuals' belief about the consequences of the behavior and its effect (positive or negative).
2. Subjective norm: Subjective norms result from the person's perception about the approval of the behavior by a given referent individual or group.

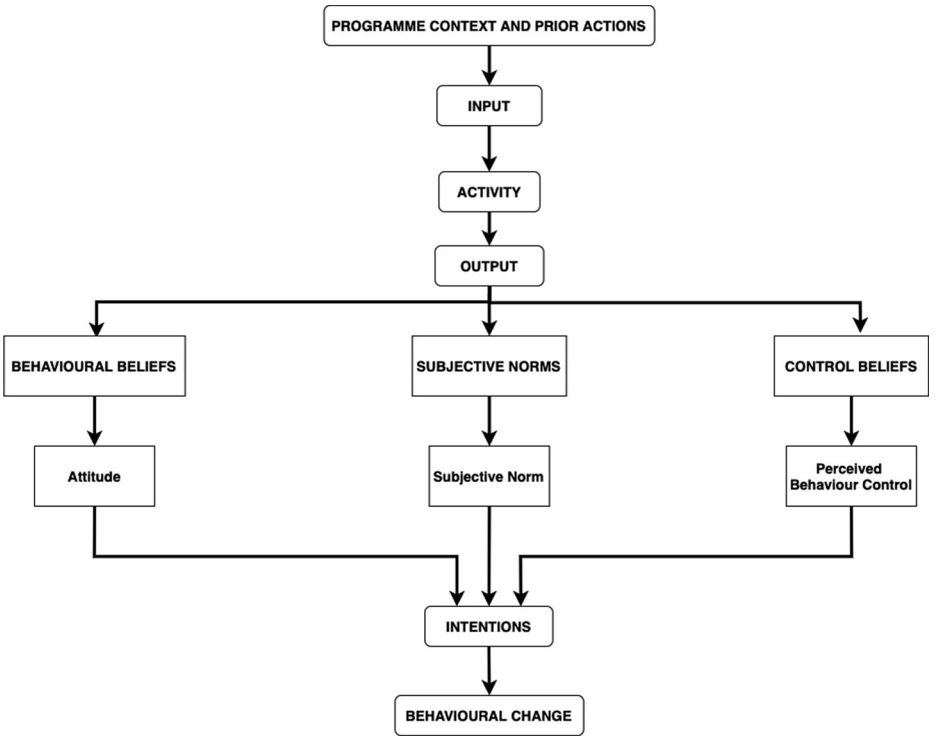

Figure 1. Behavioral change evaluation framework.

3. Perceived behavioral control: Perceived behavioral control results from the control belief of a person of whether a given facilitating or inhibiting variable is present while performing the behavior.

3.3. The behavioural change evaluation framework

The conceptual framework is developed by combining the causal links in a theory-of-change, between a plan's inputs and outcomes, with the key factors that ultimately culminate into behavioral change according to the theory of planned behavior as seen in Figure 1. This framework is referred to as the behavioral change evaluation framework.

Observed behavioral change is considered a key outcome of an intervention, in line with, for instance, Outcome mapping (Earl, Carden, and Smutylo 2001) and the narrative approaches used by Somda *et al*. (2017). However, the link between project or programme outputs and outcomes is now studied through insertion of factors that help to capture the influence of behavioral beliefs, normative beliefs and control beliefs. The attitude, subjective norm and perceived behavioral control are the three key elements, and in this framework are used as summarizing elements, informed by underlying beliefs. These are labeled as personal beliefs (shaping attitudes), normative beliefs (shaping subjective norms) and control beliefs (perceived behavioral control).

Prior to specifying the specific inputs and behavioral elements, any intervention needs to be put into its proper context (see also previous section). An important part of this context for behavioral change is formed by the experiences with prior actions,

as indicated by Aunger and Curtis (2016). Therefore, these are added as explicit elements prior to the input-activity-output chains.

4. Methodology

The developed conceptual framework is illustrated for the evaluation of a climate adaptation programme in rural India. The evaluation in this case focuses on the change in behavior that may be linked to the interventions in the programme. In the coming sections we describe the main methodological choices and key results. Further details of the method and results are available in Walawalkar (2020).

4.1. Case study selection

For the selection of this illustrative case study, three main criteria were used. First, the case should consist of a plan that was designed for climate change adaptation, with interventions aimed at behavioral change. Second, the plan should have been already under implementation for a few years. The latter would ensure that the people were subjected to the interventions of the plan for a sufficient time for them to develop an understanding of the plan. An additional pragmatic third criterion was used, consisting of access to case materials and a desire among the organizations and individuals involved in the case, to evaluate the effects of their plan as visible in behavioral change.

The BAIF Development Research Foundation's Integrated Watershed Development for Climate Proofing Programme in Maharashtra, India, was selected as a case meeting these criteria. This programme targets rural farmers to reduce their vulnerability to the impacts of climate change.

4.2. Data collection

4.2.1. Triangulation method

For the research, data were collected through personal semi-structured interviews with 20 beneficiaries of the intervention (10 men and 10 women). The sampling was done randomly from the population of beneficiaries of the plan – which had 90 active participants at the time of study.

Additionally, the BAIF field team and the official from the project's sponsor (NABARD) were also interviewed. This was followed by two focus group discussions (FGD) with seven men and seven women, who had earlier participated in the interviews. These focus group discussions were used to complement and deepen the information obtained through the interviews and to understand the differences in perspectives of the beneficiaries during a social gathering versus individual interviews. Interviews and focus group discussions were conducted by the first author in Marathi, the local language of the region, with no requirement for translation.

The interview data were complemented by observational studies at the field sites, observing the beneficiaries' farms to understand and observe the adoption of the initiatives they described during their personal interviews. Subsequently, during the programme's monitoring visit, the programme official was accompanied in the field and in the meetings. This use of different methods for data collection enabled triangulation

from different sources, to obtain a more complete understanding of the phenomenon, as prescribed by Patton (1999).

4.2.2. Questionnaire to assess behavioural change factors

To gather data regarding behavioral change, the theory of planned behavior questionnaire instrument (Ajzen 2013) was used as a basis for the design of the semi-structured interviews and focus group discussions. The questions were modified according to the case requirements for the respective theory of planned behavior factors to be evaluated (attitudes, subjective norms, perceived behavior control and past behaviors), complemented with some general background questions. For instance, the potential role of subjective norms was assessed by asking what relatives were thinking of interventions advocated by the programme, such as new cropping methods, if any relatives or friends had opposed these methods, and if any acquaintances had asked respondents to adopt these methods, and if this was found to be convincing.

4.2.3. Data analysis

The interview data were analyzed by a first cycle of deductive coding. This was carried out by arranging the interview information according to the three main factors of the theory of planned behavior (attitude, subjective norm, perceived behavioral control). Subsequently the data was further coded inductively, to find sub-codes under the common codes in all the interviews that could be categorized under the same type of theme. For instance, subjective norms could be influenced by BAIF (the implementing organization), other farmers, family, etcetera. These sub-codes, thus, were not predefined but emerged from the interview data. A similar process was used to analyze the information from the focus group discussions.

The data from the observational studies was used for validating the information from interviews and to observe actual behavioral change. This was important to understand the in-field consequences of the interventions and verify them against the perceptions of the beneficiaries.

The analyzed data was used to construct the theory of change by connecting the interventions to the respective behavior change.

5. Case results and analysis of factors of behavioural change

5.1. Programme context and prior action for the integrated watershed development for climate proofing programme in Maharashtra

BAIF Institute for Sustainable Livelihood and Development (referred as BAIF henceforth), was established as a non-profit organization. It aims to create self-employment for rural farmers while ensuring its sustainability. One of its projects is the Integrated Watershed Development for Climate Proofing Programme in the district of Ahmednagar in the state of Maharashtra, India. The goal of this programme was to reduce the vulnerability of small-scale farmers to climate change in previously developed watersheds by stabilizing, enhancing and using soil and water resources sustainably. The project was partially funded by the National Bank for Agriculture and Rural Development (NABARD).

The Integrated Watershed Development for Climate Proofing Programme is facilitated by BAIF in the village of Manhere. A gram panchayat (GP) governs the village, and the village watershed committee (VWC) tends to the watershed related decisions. Local self-help groups (SHG) aid the women financially by providing loans. The farmers in this watershed were susceptible to changing climates, especially the poor and marginal farmers. Keeping this in mind, the organization designed various interventions for the farmers to promote sustainable livelihoods despite changing climatic conditions by introducing soil nourishment and climate change resilient techniques. Amongst the activities undertaken as a part of the interventions, the following three were included in the evaluation:

1. Bio vermicompost production and demonstration: Local vermicompost production units are proposed here, using specific types of soil worms combined with aerobic decomposition of organic waste, to enhance soil fertility and soil health.
2. Demonstration of climate resilient crops: Linkages were established with institutes and experts in the field to provide information about new crop varieties that would benefit the farmers.
3. Water use efficiency measures: As climate change majorly effected the water resource, therefore meticulously using the available resource was vital. For this purpose, micro-irrigation systems such as sprinklers were proposed.

Prior to the current programme, BAIF had already worked with the village farmers in Manhere in 1989. At that time, the villagers utilized many water sources but year-round availability of water was limited. Hence, a water management programme was

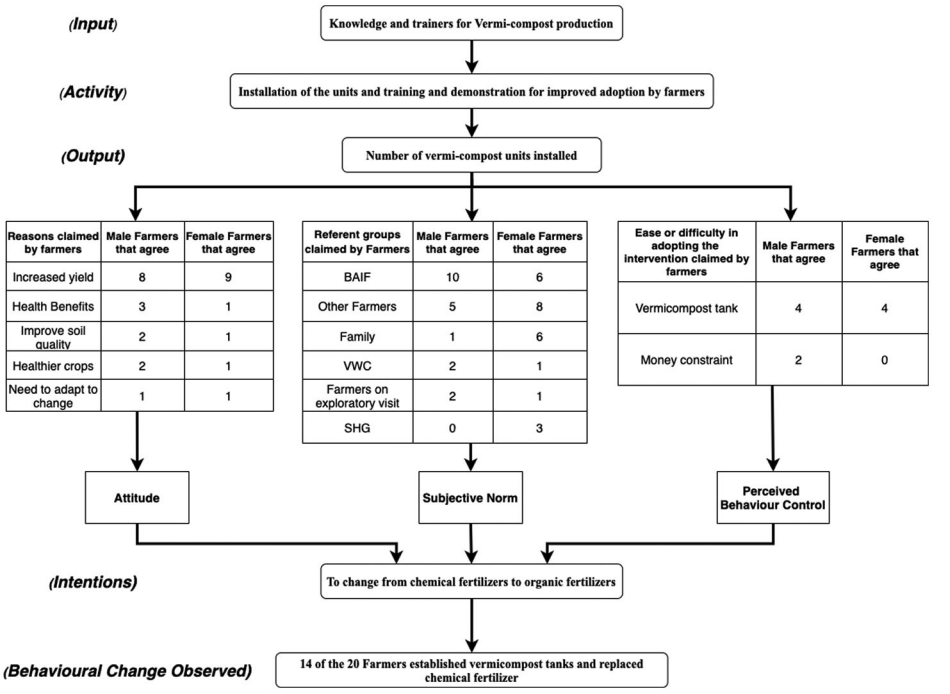

Figure 2. Bio vermicomposting intervention in the behavioral change evaluation framework.

established then, to develop strategies for the sustainable use of surface and ground water resources. However, some villagers refrained from participating in these interventions as they had a perception that this alien organization was trying to grab their land. After BAIF concluded this project in 2002, only a few farmers continued to invest efforts in the project and benefited from it (Walawalkar 2020).

5.2. Bio vermicompost production

Through the intervention of vermicompost production, BAIF aimed to introduce the farmers to the methods to improve soil health. The visual representation of this intervention in the behavioral change evaluation framework is as seen in Figure 2.

The attitude of most of the farmers was influenced by their expectation that the intervention was able to increase their yield, which was considered vital by both male and female farmers. The men, although on a smaller scale, also considered health benefits, improved soil quality, and healthier crops as important reasons to adopt the intervention. The women, however, did not demonstrate a similar conviction.

According to the male farmers, their subjective norms were influenced by BAIF and other farmers. They were confident about making the change from chemical to natural fertilizers as it was promoted by BAIF and other farmers who had experienced the benefits of this change. Most of the male beneficiaries agreed with this. Two of the ten interviewed suggested that the village watershed committee also played a role in them adopting this change. For the eight female farmers it was mostly the other farmers that motivated them to use natural fertilizers. Additionally, other than BAIF, six of the female farmers agreed that the opinion of their family, especially their husbands was critical. On a smaller scale, the other women in their self-help groups also stirred them toward this change.

Perceived behavioral control was positively influenced by the introduction and guidance provided to build the vermicompost tank. This was conducive for both the male and female farmers to replace the chemical fertilizers with vermicompost. Additionally, as the vermicompost tanks were built at subsidized rates for the women in the self-help groups, four of the female participants claimed that it further facilitated their uptake. Some of the male farmers expressed an inability to adopt this change, owing to the higher investment cost and due to their personal financial constraints.

The activities of demonstrating and introducing the farmers to a method of composting and soil management led to a positive change in attitude in the beneficiaries, as they claimed they expected benefits from this intervention. Similarly, the people important to the beneficiaries promoted the intervention, thus depicting a positive influence on the subjective norms. Furthermore, the introduction to vermicompost tanks and their utilization provided the farmers with the guidance they required to replace chemical fertilizers. Nevertheless, the constraint of money would prevent some of the beneficiaries from making this change. Hence, it can be seen that the intervention will lead to a positive intention when there is no financial shortage that constrains the perceived behavioral control.

Since the intention is a precursor to behavioral change (Ajzen 1991), it should lead to farmers establishing vermicompost tanks and substituting chemical fertilizer with this compost. This change in behavior was also claimed by 14 of the 20 local interviewees and these claims were verified by conducting observational studies. The vermicompost tanks indeed were observed on the farms of most beneficiaries and the compost was continuously used while new batches were in preparation, thus suggesting

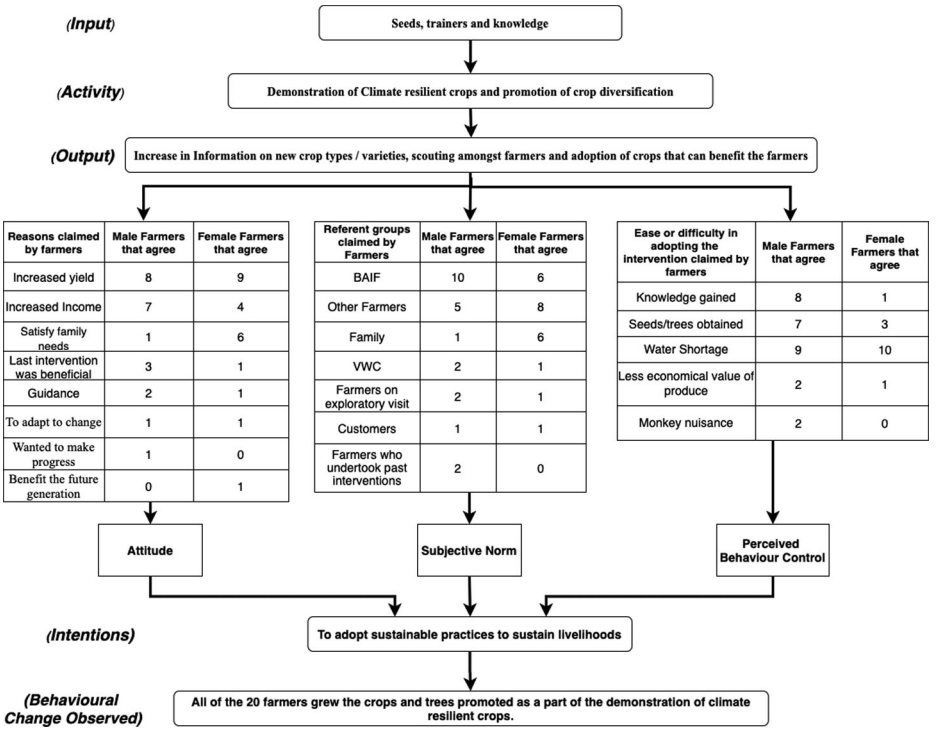

Figure 3. Demonstration of climate resilient crops in the behavioral change evaluation framework.

that the intention has been converted into a behavioral change. In conclusion, it can be stated that the intervention to introduce bio vermicompost has led to an intention to adopt it amongst beneficiaries, which is also an observable behavioral change in them. However, they will only adopt this intervention if there is no money constraint.

5.3. Demonstration of climate resilient crops

The demonstration of climate resilient crops aimed to increase the knowledge amongst beneficiaries about climate resilient agricultural methods and ensure their adoption. According to the interviews conducted, the beneficiaries reported positive consequences of the interventions, as seen in Figure 3. All 20 interviewed farmers, men and women, claimed to have adopted one or more new varieties of crops to increase their yields.

Seven out of the ten male farmers stated that these new crops were also their means to increase their income. Although their female counterparts did share the same view, an additional reason for six of them to adopt these new varieties was to ensure that they could satisfy their families' daily needs. While the male farmers found monetary benefits important, the female farmers were more interested in availability of sufficient produce to meet family needs. Additionally, guidance on crop diversification and its benefits, adapting to change, and benefits for future generations, were amongst the other reasons to facilitate the adoption, mostly by male beneficiaries.

BAIF, farmers who had benefited from earlier interventions, and the village water committee were amongst the most important groups for the male farmers. The female

farmers considered the farmers who had benefited, family, BAIF and self-help groups, as their inspiration to take up the new varieties. However, one man and one woman also claimed that the opinion of the customers was important. Additionally, some of the male farmers claimed that the experience of farmers who were associated with BAIF for 15 years, helped to build their trust in these new interventions.

According to eight male beneficiaries, demonstrations empowered them with the knowledge they affirmed to lack, therefore easing the uptake of the new methods. Moreover, for both the genders the intervention also provided them with the new varieties of seeds and samplings of trees to undertake farming of either climate resilient crops or cash crops. These resources facilitated the change in cultivated crops. Nonetheless, there were still difficulties that hindered the successful implementation of this intervention. According to nine male and all the female farmers, they could continue to adopt these changes only in the absence of water shortage, as the maintenance of trees in the initial period of growth required more water. Therefore, the availability of water could be a major obstacle to maintain the change. Barring the availability of water, economic value for produce and the damage caused by monkeys to fruit trees was also challenging to some of the male and female farmers.

In sum then, according to the analysis with the behavioral change evaluation framework, it can be stated that the demonstration of climate resilient crops triggered a positive attitude and likely intention for adoption based on perceived benefits that were important to the referent groups, while the knowledge and seeds provided made it easier to adopt the intervention. Still, a major concern for the farmers while changing to climate resilient crops was the availability of water. The farmers' intention to change could be seen in the claims by all farmers of changes toward more climate resilient crop cultivation during the interviews. These claims were confirmed by direct observations in the village. However, this could be expected to continue only as long as water would remain available. Other obstacles that the farmers faced were challenges they would need to overcome, but seemed not to hamper their eventual adoption of activities.

5.4. Water use efficiency measures

This intervention consisted of a demonstration and assistance with installation of water use efficiency measures on farms such as micro and drip irrigation. Although only two of the male beneficiaries claimed to have adopted the measures to use water more efficiently, the other male beneficiaries agreed to the potential benefits of using these techniques. According to these farmers, the reason to take up these interventions was to reduce water wastage. The two farmers who adopted the measures also affirmed that they could now irrigate their farms with fewer efforts as compared to watering the farms manually, as seen in Figure 4. None of the female beneficiaries had adopted this intervention, but four of them claimed they realized its importance. On the contrary the other six female farmers were completely unaware of these measures as they did not attend training and followed the farm-related decisions taken by their husbands.

While the number of beneficiaries engaging in this activity were less, the farmers who had not yet been engaged were also considering these measures, after observing the farmers who had adopted them. Both male and female farmers stated that BAIF and farmers who benefited from these measures inspired them to take it up. Furthermore, by observing farmers who had taken up these measures, on their

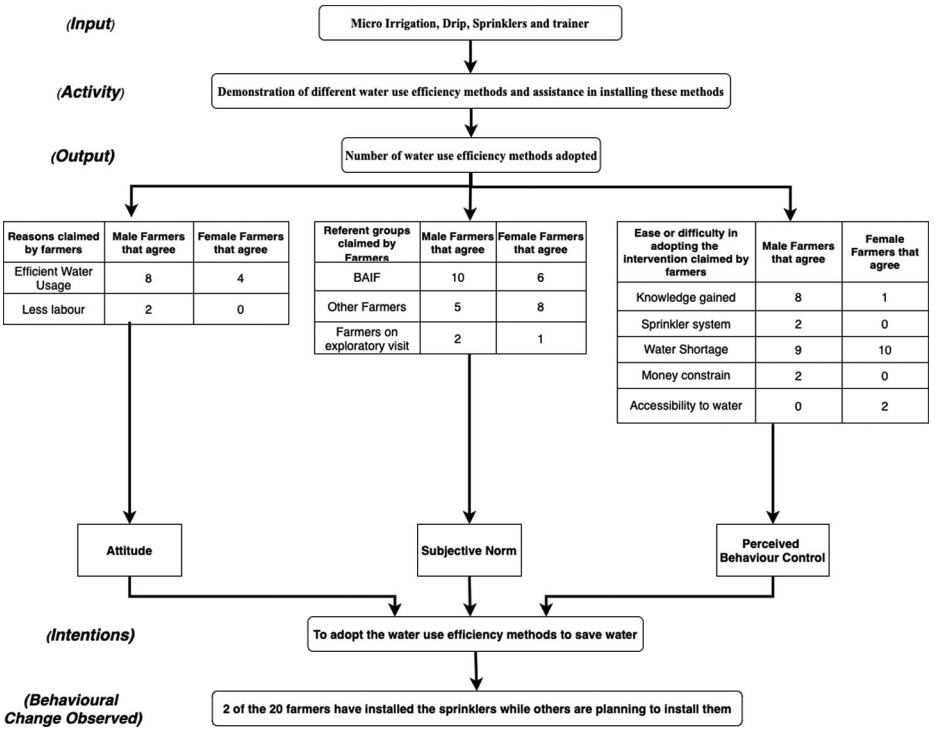

Figure 4. Water use efficiency intervention in the behavioral change evaluation framework.

exploratory visits outside the village, two of the male farmers from Manhere village were influenced to build on their experience.

The knowledge about the sprinkler systems and the equipment provided by the intervention, enabled and motivated most of the male farmers to install the irrigation methods. As none of the female beneficiaries had installed these measures, they did not claim their comfort in implementing the intervention. However, water shortage and its accessibility played a major role in all the beneficiaries' intentions to install an irrigation device; Two of the female farmers claimed that they could not install such a system due to inaccessibility to water storage structures such as wells. Another obstacle for some of the farmers was the monetary investment it required.

As aforementioned, only a few beneficiaries were benefiting from the methods to use water efficiently, but these farmers promoted the intervention widely. Although there was an intention of adoption by the other farmers, it was hampered by the financial investment required and the availability of accessible water. The analysis using the behavioral change evaluation framework suggests that although the benefits and promotion of the intervention were positive, the above mentioned constraints prevented the beneficiaries from implementing the activity and therefore they did not show the expected behavioral change by installing the irrigation systems.

5.5. Cross-cutting insights on the climate proofing programme

As seen above, most of the farmers in Manhere believed that the interventions would provide them with better crop yields and more efficient use of water, which would be

useful to satisfy their family needs or gain more income. Additionally, since these interventions were promoted to them by BAIF, by family members or by farmers who had benefited from earlier similar interventions, they gained the confidence to undertake these interventions. Further, the provision of training, seeds, sprinkler equipment and guidance during implementation aided the majority of farmers to convert their positive intentions into actions for two out of three interventions.

Nevertheless, the success of these interventions was pertaining to the prevailing conditions. Changes in the future situation of Manhere such as alterations in the availability of water could impede the farmers' actions. Especially increasing water shortage is a factor for perceived behavioral control that could obstruct the future ability of the entire community to continue the interventions; This was claimed by 19 out of 20 interviewed beneficiaries. Thus, the programme's objective of introducing sustainable livelihoods that would be adaptable to climate change, is challenged by the uncertainty of water availability. In a way this is ironic, because one of the projected consequences of climate change is indeed more uncertainty around water availability, with risks of increased inter-annual variability and possibly a further reduction in rainfall. This suggests that in addition to the current focus of the programme, more attention is needed for larger scale water management interventions, beyond farm-level, and/or for more far-reaching livelihood options to deal with future risks of reduced water availability.

In addition to an overall evaluation of a plan, the behavioral change evaluation helps to uncover important differences between the perceptions of the two genders. For instance, the inaccessibility of water, despite its availability at village level, is a major obstacle for some of the women who fetch it. Similarly, the attitudes of male beneficiaries are mostly influenced by perceived financial benefits, whereas the female farmers want greater yield to satisfy their families' requirements. This disparity is also visible with respect to the referent groups that are important to each of the genders. While the male farmers are influenced by BAIF and other farmers' views, their female counterparts depend on the decision of their families, especially husbands, to make a change in their farming behaviors. These insights suggest that the interventions could be further improved by using different communications channels, as well as different mitigating or enabling measures, for the different parts of the target group in the community.

6. Discussion

The use of theory of planned behavior as the basis for our behavioral change evaluation framework helped to reveal not only the behavioral changes but also the details of the precursors that led to it. This helped to show that, although the beneficiaries may require the same intervention to adapt, their perceptions of these interventions are dictated by their socio-cultural environment. In this case, there were clear differences in the factors that influenced behavioral intentions and actual change between male and female farmers. This is in line with the study by Grothmann and Patt (2005) and it shows that the use of the behavioral change evaluation framework (and similar behavioral frameworks) needs to be accompanied by a clear identification of possible meaningful differences within target groups, early on in the process.

We did not restrict the use of the behavioral change evaluation framework to the lifespan of the evaluated programme. Starting with a step to map "Programme Context and Prior Actions" helped to surface the important influence of activities in which

BAIF and the village beneficiaries engaged approximately twenty years ago. The observed effects of earlier similar interventions seem to have provided a strong influence on the farmers' behavioral intentions. This may explain why, in this case, cultural or habitual constraints to change could be overcome, given the observed crop yield benefits for earlier adopters in the village. Although these are not climate adaptation motivations per se, they do help to explain the programme's effects.

The evidence obtained from the evaluation of the ongoing interventions will also help BAIF to design their future interventions – among others to address observed (future) constraints and to differentiate the interventions to the different groups of the society according to their perceptions about the required change. This broader and future-oriented learning is in line with benefits from climate adaptation evaluations as suggested by Leiter and Pringle (2018), and it adds history and prior experience as an important aspect to the 'standard' applications of the theory of planned behavior in other domains.

Finally, some limitations and future challenges emerge from our results. Results for this case were obtained through mostly qualitative analysis and fairly straightforward quantification based on a (randomly selected) sample of twenty interview respondents, focus group discussions and field observations. The question remains whether the complex issue of climate adaptation behavior can be assessed with such a relatively lightweight approach.

For many relatively small organizations and programmes, a lightweight approach may be all that is considered feasible, given financial and other resource constraints. In this case, for this village, the behavioral change evaluation framework provided a clear picture with insights that can be considered useful and sufficiently valid. For larger evaluations, across larger target groups, the validity of evaluation results would need to be increased. This could be done with the behavioral change evaluation framework by using a survey with a larger sample size. It is expected that the first analysis steps reported here, would still need to be done and would help in the design and execution of a larger survey, using more advanced statistical analysis for these larger samples. However, with more resources and more advanced analytical techniques, one may also consider a more complete but complicated theoretical framework, instead of the relatively straightforward linear model of the theory of planned behavior.

7. Conclusions

Although it is known that climate change adaptation depends on the long-term behavioral change amongst beneficiaries, the evaluations to understand these changes are still at its beginning. In this study, a behavioral change evaluation framework was developed to evaluate these changes in behaviors corresponding to the interventions aimed at increasing adaptability, while understanding the underlying reasons for the same. The framework was used for an evaluation of behavioral interventions in a climate adaptation programme aimed at small-scale farmers in India. For this illustrative case, the framework was able to highlight the factors that shaped farmers' intentions and observed behavioral changes as targeted by the programme. Additionally, it generated broader insights that are useful to understand the social aspects while implementing a climate change adaptation plan. Although only a single and limited case, these findings suggest that a behavioral change evaluation framework holds promise for the

monitoring and evaluation of adaptation behavior, and learning for more impactful climate change adaptation programmes.

The behavioral change evaluation framework is based on the theory of planned behavior. It has one important addition. It looks into context and especially past experiences and prior actions. The theory of planned behavior does not address this factor (Ajzen 1991). But it is important for climate change adaptation, as it is a longer-term iterative process, which means that it relies on evaluation and learning of past experiences. In our case study, an earlier intervention that took place quite a few years ago, still played an important role in the beneficiaries' intentions to undertake the recent interventions. Hence, the use of behavioral change frameworks for the continuous evaluation of adaptive capacity, would benefit from incorporating this dimension of past experiences.

An effective evaluation of climate change adaptation plans can generate knowledge and learning that are useful for informing future policy and practice. Our findings with the developed theory-based evaluation framework for behavioral change indicate that including the behavioral dimensions in these evaluations will aid organizations to understand the complex social contexts within which the adaptation occurs. Identifying the mentioned supporting and impeding factors for behavioral change may not only help in effective implementation but also guide government planners and funding agencies to make investments in a more effective manner.

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