EXPERIENTIAL LEARNING TO SUPPORT COMMUNITY BASED CLIMATE CHANGE ADAPTATION IN THE ZAMBEZI REGION OF NAMIBIA

by

FRANZISKA AGNES URSULA AUCH, BS

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Franziska Agnes Ursula Auch, MS
The University of Texas at Dallas, 2024

Supervising Professor: Jessi Hanson-DeFusco

The consequences of climate change have a profound impact on communities around the world over a long period of time. For the majority population in particular, it is essential to adapt to the implications of climate change in order to ensure their own wellbeing and the wellbeing of future generations. The actions of the current generation have a significant impact on the well-being of future generations who are unable to respond to these decisions. In this context, behavioral games can provide a platform for reflection and discussion on intergenerational equity and climate change adaptation strategies. Using an Intergenerational Goods Game and a visioning workshop, we investigate whether experiential learning supports community-based adaptation to climate change in the Zambezi region of Namibia. Our results indicate a significant increase in self-efficacy after participating in the game and workshop, as well as an increased demand for information about climate change impacts. However, there is no notable impact on the relationship with future generations and on awareness of the multigenerational dilemma. Overall, this study confirms the effectiveness of the experiential learning approach and motivates further research on behavior change in the context of community-based climate change adaptation.

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CHAPTER 1

INTRODUCTION

Intense rainfall and prolonged periods of drought create severe living conditions for the affected communities and point out the consequences of climate change worldwide (IPCC, 2023). While people in the Minority World (nations with less than 20% poverty rates) have so far experienced fewer impacts of climate change and are primarily focused on efforts to mitigate climate change, inhabitants in the Majority World have to cope with the necessity of adapting to its effects (IPCC, 2023). Affecting a large number of people over a long-time horizon, climate change has far-reaching impacts (IPCC, 2023). The actions taken by the present generation significantly influence the welfare of future generations, who have no option to respond to the current generation's decisions (Page, 1999). This multigenerational social dilemma is further compounded by high uncertainty and complexity of environmental change and makes it hard to overcome individual and collective interests for current and future generations (Hardin, 1968). In order to effectively adapt to the effects of climate change and ensure the well-being of future generations, radical innovations are required (Peschl et al., 2010). Besides technical and institutional innovations, this also involves reassessing behavioral patterns that are unconsciously established and maintained. Thus, changing mindsets and cultural norms for transformative systemic change becomes a valuable approach in environmental policy interventions (Abson et al., 2017).

In this study, we use a behavioural game as space for reflection and discussion on the topic of intergenerational justice and climate change adaptation strategies. We want to employ economic games not only for data collection on decision-making but also as effective learning tools. To contribute to a growing amount of research on the impact of game playing on mental models of participants, suggesting the potential for long-term behavioral change (Baird et al., 2014; Bartels et al., 2022; ElDidi et al., 2023; Falk, Zhang, et al., 2023; Meinzen-Dick et al., 2018; Meyer et al., 2021), we aim to explore the effects of playing an intergenerational goods game (IGG) on experiential learning to support community based climate change adaptation. We assess whether playing an intergenerational game increases awareness for risks related to climate change (1); reduces place attachment (2); increases the information demand on climate change (3); increases

empathy for future generations (4); increases self-efficacy (5); and increases prosperity expectations (6).

We use the "Intergenerational Community-Based Climate Change Adaptation Game" inspired by Gross & Böhm (2020), Hauser et al. (2014), and Lohse & Waichman (2020) to place players in a game situation where they need to take decisions in the interest of future generations and choose between an individual or a collective climate change adaptation strategy. To increase the potential learning effects of the participants we allow for communication during the game, including a subsequent debriefing session and visioning workshop (Crookall, 2023; Falk, Zhang, et al., 2023). With a subsample of the participants, we conduct a learning outcome survey, that allows us to create indices in order to test our five hypotheses. We use a between-subject design interviewing some players before the game, some between the game and the visioning workshop, and some after the workshop. The whole process has been implemented in 26 communities in the Zambezi region of Namibia with in total 520 participants. 291 participants took part in the learning outcome interview.

This research is part of the NISANSA project, which focuses on the social impacts of climate change and related sustainability innovations in the Global South. Specifically, sub-project 4 of NISANSA, which runs from June 2021 to June 2024, examines the behavioral dimensions of intergenerational equity among the challenges of climate change and develops strategies to support long-term oriented behavioral change.

1.1 Economic Games as Learning Tools

Research on leverage points for sustainable change shows that many sustainability interventions focus on simple and low-cost leverage points, leading to a lack of sustainable transformation in the long term (Abson et al., 2017). Considering the twelve leverage points introduced by (Meadows, 1999), it becomes clear that the less tangible leverage points are the most efficient. On this basis, Abson et al. (2017) emphasize the importance of changing mindsets and cultural norms for transformative systemic change, which are among the deep leverage points. Therefore it is inevitable to strive for an increase in experiential connection between people and nature to promote a change in mental modes (Abson et al., 2017; Janssen et al., 2023). Furthermore, research from

psychology shows that in order to promote lasting change, it is essential to focus on encouraging strong engagement, developing mental models and shaping social norms (Goldberg et al., 2020). These elements are not mutually exclusive but work synergistically when combined. For example, through in-depth discussions with close members of one's social community in the context of playing a behavioural game, individuals have the potential to change their mental models, which can lead to transformative behavioral change over time (Crookall, 2023). In past and current sustainable development projects, the need to change mental models is often neglected. As a result, participants are often not sufficiently trained to take individual or collective action to protect themselves and future generations from the effects of climate change. Thus, development projects that for example aim to change the management of natural resources often do not have a long-term impact after implementation (Abson et al., 2017).

Playing behavioural games can raise awareness of certain problems and motivate players to formulate solutions on their own (Falk et al., 2019). As games provide a safe space, incorporate an explorative and low-risk nature, and establish trust through communication (DeCaro et al., 2021), communities can experimentally explore the role of institutions, social and cultural norms, and desired behaviors and outcomes collectively (Cardenas & Carpenter, 2005). By including the multigenerational dilemma in the context of climate change and experiential learning games, participants can playfully explore the effect of the present decision on future generations and thus the well-being of their children. This highlights the potential of using games as learning tools to foster experiential learning and thus collective change in terms of sustainable behavior.

Game theory models are used to strategically examine the players' decision-making options in certain situations. It operates under the assumption of rationality and complete information and seeks the optimal solution in which no individual can be better off without another being worse off. This field encompasses various games, including two-player binary choice games like the prisoner's dilemma, chicken game, and assurance game, as well as those involving multiple players (Perman et al., 2011). Different types of cooperation games delve into the impact of social preferences such as fairness, altruism, trust, cooperation, and reciprocity and thus having their own dynamics and challenges. In environmental economics, public goods games are often used to model the tragedy of the commons (Hardin, 1968): all players are contributing resources to a

common pool, whereby the total investment is multiplied and distributed evenly among the participants, so that free-riding is easily possible and a challenge to overcome. The game structure of the dictator game, on the other hand, can be associated with the multigenerational dilemma, in which the future generation cannot influence the decisions of the current generation: one player (the proposer) making a one-time offer to another player (the responder), who has no option to influence or respond to the proposer's decision. In a multigenerational dilemma, mechanisms such as sanctions or communication which are well known from the economic literature to influence decision making, are not feasible. Introduced by Hauser et al. in 2014, IGG have a related game structure of the combination of public goods and dictator games. It contains elements of the tragedy of the commons and offer future generations no opportunity to influence the decisions of the current generation. This dynamic makes it possible for the current generation to act as free riders, which eventually compromises the well-being of future generations. Consequently, IGGs model the conflict of interest between present and future generations, offering valuable insights into multigenerational dilemmas (Ding et al., 2023). By varying the game structure with a threshold, an environmental framing and recognizing the interdependence between individual and collective solutions in the context of a multigenerational dilemma, insights can be gained into the complicated dynamics of decision-making in IGG. This approach sheds light on the complexity associated with addressing long-term consequences and resource allocation across generations.

The origins of policy games trace back to the military strategies of the early 19th century. In the 1970s, these games were also used in the field of international relations and crisis management (Haug et al., 2011). Over time, their application has been extended to environmental and socio-political challenges, reflecting the growing recognition of the value of strategic simulations in tackling complex problems in the real world (Haug et al., 2011). According to the framework of Janssen et al (2023), it is to differentiate between experiments that are focusing on causality and games which focus on learning. Experiments are typically carried out in laboratories and aim to test a specific hypothesis in a controlled environment. The players' decisions typically affect individual earnings without consideration of framing or relational values, often maintaining an abstract and anonymous nature. In contrast, learning games are usually conducted in the field, have a participatory approach and include relational values through framing, role allocation or a

debriefing after the game (Venot et al., 2022). Role-playing games can also be learning games, which are complex system-dynamic models within specific socio-ecological-technical systems (Janssen et al., 2023). The greater complexity of learning games compared to experiments, and in particular the inclusion of relational values in the game design, allows the game to have an impact on participants' learning (Janssen et al., 2023).

1.2 Using Experiential Learning to Stimulate Behaviour Change

In their literature reviews, Den Haan & Van Der Voort (2018), and Flood et al. (2018) examine publications on games in the field of climate change. They find evidence of experiential learning through participation in different types of behavioral games. However, the majority of literature mainly focus on technical skills, such as acquiring new knowledge, and conceptual understanding (Den Haan & Van Der Voort, 2018, p. 10). For example, in a participatory decision-making process for climate change adaptation in the Niagara region, Canada, Baird et al. (2014) found clear evidence for experiential learning in general, highlighting cognitive and relational learning. These results are consistent with the findings of subsequent studies that have investigated the acquisition of new knowledge through playing a behavioural game in the context of natural resource management (Becu et al., 2017; Ferrero et al., 2018; Garcia et al., 2022; Martin, 2015). Further research shows that participation enhances community decision-making in general (Rumore et al., 2016), which can be confirmed by the results from a groundwater game played in Andhara Pradesh, India (Meinzen-Dick et al., 2016, 2018). Additionally, a pest-management game implemented in Lao PDR revealed that participants gained insights into the advantages of collective action and developed a deeper understanding of others' willingness to engage in such collective efforts (Meyer et al., 2021).

It is important to recognize that the impact of behavioral climate measures varies depending on the target group and target behavior (Vlasceanu et al., 2024). Factors that can affect the magnitude of the effect include the degree of activity level (Baird et al., 2014), previous knowledge levels about climate change (Rumore et al., 2016; Vlasceanu et al., 2024), and the level of motivation and interest (Falk et al., 2023a). Additionally, the role of women can play a significant role (Falk et al., 2023b), alongside educational background. On the other hand, there are indications that

factors such as education, gender or trust have no significant influence on the results of experiential learning (Meinzen-Dick et al., 2018).

On the basis of three research cases on games for experiential learning, (Falk et al., 2023a) discuss how behavioral games can trigger behavioral change effectively. Besides emphasizing the effects of game design and player attributes on experiential learning outcomes, they show that experiences in experiential learning action situation can influence behavior in real-life action situations. If the theory of change is built around a real-life social dilemma, behavioural games can activate deliberate decision making, and lead to possible spillover-effects. Especially, allowing for communication during the game and debriefing sessions after playing a behavioural game revealed that participants were able to connectthe game to real-life experiences (Bartels et al., 2022; ElDidi et al., 2023; Falk et al., 2019; Meinzen-Dick et al., 2016, 2018). However, by incorporating real-life situations, behavioural games become highly contextualized, and harder to apply in a low-cost and large-scale manner. Though, Meinzen-Dick et al. (2016, 2018) have demonstrated the potential for large-scale expansion of behavioral games through the implementation of their research on a groundwater game in a total of 184 communities across India. It is important to recognize that there is an undeniable "trade-off between the simplicity and relatability of games and their contextual specificity" (Falk et al., 2023a, p. 9).

1.3 Conceptual Framework

Building on the aforementioned studies and their valuable findings, our aim is to explore the concept of experiential learning in the field of intergenerational justice and climate change adaptation strategies. To the best of our knowledge, this study sheds novel light on changing mental modes during and after the decision-making process in an IGG in the context of climate change. In this respect, the hypotheses of this study rely on six major frameworks:

1. Public awareness of potential implications of climate change

While there is a considerable body of research on public awareness of potential implications of climate change, it is notable that most studies come from the Minority World, indicating a need for more robust and diverse research in the Majority World (Van Der Linden, 2017). Nevertheless, many studies highlight the central role of awareness in influencing general behavior change

intentions, but the exact link to real-world adaptation decisions remains unclear (Van Der Linden, 2017). Moreover, awareness in relation to climate change still lags behind other prominent social challenges such as economic instability or health problems (Van der Linden, 2017). This discrepancy could be due to the inherent uncertainty and complexity of environmental change. Climate change, with its enormous scale and profound impacts, is often perceived as overwhelming, which further complicates the assessment of perceived risks and awareness towards environmental challenges. Individual awareness of the potential consequences of climate change is influenced by various cognitive, socio-demographic and experiential factors (Siegrist & Árvai, 2020; Van Der Linden, 2017). In particular, the availability of adequate information (cognitive), or gender, race and political identity (socio-demographic) play an important role. However, experiential factors, such as personal experience with phenomena like droughts and floods, can also significantly increase risk perception.

In the New England Climate Adaptation Project, Rumore et al. (2016) showed that participants expressed increased concern and awareness of the risks of climate change after participating in a role-play simulation and a debriefing session. For participants who had less knowledge or concern about climate change before participating in the game the effects are larger in magnitude. Assuming that participants possess the ability to relate the experiential situation in the game to real-life scenarios, we expected that playing a behavioural game will change public risk perception about climate change and in the long-term may lead to pro-environmental behaviour change.

H1. Playing an intergenerational game and participating in a visioning workshop increases awareness for risks related to climate change.

2. <u>The role of path dependency on place attachment</u>

Today's actions are shaped by past actions, a phenomenon often described as path dependency. These dependencies, whether technological, institutional or behavioral, predispose individuals to improve existing socio-technical systems rather than seeking fundamentally new solutions that may be essential to tackling climate change (Goldstein et al., 2023; Seto et al., 2016). Furthermore, there is a risk that the current generation will rely too much on habits and narratives that have

proven effective in the past, potentially overlooking alternative pathways leading to a future with business as usual (Goldberg et al., 2020).

This concept interlinks closely with place attachment of people to their homes. Path dependencies can lead to inaction with regard to sustainable change and thus to an increased likelihood of forced displacement due to the consequences of climate change. A strong sense of place further lead people to underestimate the risks of climate change in their immediate surroundings (Lie et al., 2023). This effect might be even stronger in rural areas, as inhabitants of small communities tend to show higher levels of place attachment, possible due to a closer connection to the local environment compared to urban areas (Lie et al., 2023; Tenbrink & Willcock, 2023). On the other side, studies of IGGs played in Bangladesh and Nepal show that intergenerational sustainability and prosocial behavior tend to be more pronounced among participants living in rural areas (Shahrier et al., 2017; Timilsina et al., 2022). A comprehensive literature review by Nicolosi and Corbett (2018), which includes 66 studies, highlights a positive correlation between place attachment and active engagement with environmental issues. According to Lie et al., (2023), place attachment may serve as both a mediator and a moderator between risk perception and coping behavior.

Based on our first hypothesis that risk perception in relation to climate change increases after our intervention (H1), we expect place attachment to decrease. Furthermore, the game design of our behavioural game is such that it raises participants' awareness of potential lock-in effects, path dependency and risks related to climate change, emphasizing the need for behavioural change.

H2: Playing an intergenerational game and participating in a visioning workshop reduce place attachment.

3. Value of knowledge about adaptation strategies and impacts of climate change

In general, knowledge is an important driver of pro-environmental behavior, with effects varying depending on the individual's pre-existing level of knowledge (Rumore et al., 2016). Most of the evidence in the experiential learning literature suggests that playing behavioral games leads to an increase in knowledge and thus there may also be an increase in the demand for knowledge. Acquiring new knowledge can further lead to a higher perception of risk and thus can act as a

trigger for the individual or collective protection of communities from the consequences of climate change.

As we expect that our intervention leads to an increase in risk perception and a consequential decrease of place attachment, we assume that participants are in need for additional information regarding adaptation strategies and possible impacts of climate change to their community. An increase for information demand is crucial as it can enable community members to find solutions to protect their community against the implications of climate change and to leave possible path dependencies.

H3: Playing an intergenerational game and participating in a visioning workshop increases information demand about climate change.

4. Intergenerational justice in the context of climate change

IGG studies, often conducted in the form of laboratory experiments, show that participants are more likely to collaborate within their own generation, as they tend to contribute more to the cheaper short-term measures than to the more expensive long-term measures (Böhm et al., 2020; Ding et al., 2023; Fornwagner & Hauser, 2022; Hauser et al., 2014; Hurlstone et al., 2020; Lohse & Waichman, 2020; Shahen et al., 2021). However, higher education (Fornwagner & Hauser, 2022), pre-existing knowledge, as well as treatments like punishment (Lohse & Waichman, 2020) or voting (Hauser et al., 2014) have the potential to increase intergenerational cooperation. According to Alvi et al. (2023), people who show empathy towards the future are often more committed to environmental protection than those who value the present. This can be confirmed by Heinz & Koessler (2021), who show in their literature review that people with other-regarding preferences, thus preferences that are related rather to the well-being of others than themselves, are more likely to show a pro-environmental behaviour.

Assuming constant time preferences, we expect that our intervention will improve pro-social and other-regarding preferences towards future generations, leading to an observed increase in empathy towards future generations.

H4: Playing an intergenerational game and participating in a visioning workshop increases empathy towards future generations.

5. Self-efficacy as an opportunity to take action in the face of overwhelming global change

Self-efficacy theory gained prominence in academic literature in the late 1970s, initially conceptualized by Albert Bandura. It refers to the belief of people that they are able to individually influence a situation and change their behaviour (Vaughan-Johnston & Jacobson, 2020). The individual perception of self-efficacy is seen as a major driver for behavioural change: individuals with higher self-efficacy are more likely to engage in climate change adaptation strategies. However, the level of self-efficacy depends on factors such as place of residence (urban or rural; duration of residence) and education (Muroi & Bertone, 2019; Ung et al., 2015), or age and income (Muroi & Bertone, 2019). In addition, self-efficacy can be indirectly influenced by the degree of awareness towards possible implications of climate change (Bradley et al., 2020). A higher awareness can lead to less inaction on climate change, which is positively and sequentially mediated by beliefs about climate change and the effectiveness of environmental action (Wang et al., 2021). Engaging in behavioural games can enhance attitudes towards climate change and environmental self-efficacy (Fernández Galeote et al., 2023). Therefore, we hypothesize accordingly:

H5: Playing an intergenerational game and participating in a visioning workshop increases self-efficacy.

6. Change in prosperity expectation today, in 10 years, and in the future

Theoretically, a distinction is made between emotional well-being, which refers to the emotional content of daily experiences, and life evaluation, which comprises an overall assessment of one's own life (Kahneman & Deaton, 2010). While our study aims for participants to enjoy our workshop day, our primary goal is to use the behavioral game and visioning workshop to connect theory to real-life situations. Through this intervention, we aim to work with communities to identify ways to protect them from the impacts of climate change and promote sustainable development, thereby improving the wellbeing of the communities. Further, we want to inspire community members to

take proactive measures to support local communities and positively influence their perception of their quality of life today, in the future and towards future generations. We assume that the empowerment felt by communities through our intervention will lead to greater optimism about the future.

H6: Playing an intergenerational game and participating in a visioning workshop increases the prosperity expectations of the future of the current generation as well as for their children and future generations.

CHAPTER 2

MATERIAL AND METHODS

2.1 Study and Game Design

The study was pre-registered on 29 March 2023 under aspredicted.org, file No. 127109. The project has further been ethically approved by the Institutional Review Board (IRB) and the Faculty Research Ethics Committee of the Namibian University of Science and Technology.

2.1.1 Research Site

Our research was conducted in the north-eastern part of Namibia, particularly in the Zambezi region. The region encompasses an area of 606,800 hectares and is inhabited by approximately 100,000 individuals. Characterized by woodland savannah, the region experiences an average annual rainfall varying from 650 mm in its western regions to 900 mm in the east. The primary source of livelihood for the majority of the population is smallholder farming, which involves a mix of crop cultivation and livestock rearing. Hughes & Farinosi (2020) predict a significant increase in droughts and an escalation of heavy rainfall events for the Namibian Zambezi region. This is in line with the model forecasts by Martínez-Capel et al. (2017), who expect a significant increase in extreme events by 2050. Another reason for choosing the Zambezi region for our research was the extensive expertise of our Namibian partner (Namibian University of Science and Technology) in this area.

2.1.2 Game Design

Following the design of games with intergenerational goods, the game used in this study is based on Gross & Böhm (2020), Hauser et al. (2014) and Lohse & Waichman (2020) and integrates key elements aimed at evaluating the impact on experiential learning. By dividing the participants into two groups representing the current and future generations, the “Intergenerational Community-Based Climate Change Adaptation Game” (IGAG) authentically reflects the multigenerational dilemma. Especially in the context of the changing weather patterns in recent years, which can be attributed to climate change in the Zambezi region, the participants find themselves in a real-life

situation and can thus possibly apply the game experience to their private lives. The game structure of the IGAG effectively embodies the concepts of intergenerational justice and climate change adaptation challenges by combining the basic structure of a Dictator Game with a Public Goods Game.

The IGAG consists of ten players per session, who are divided into two generations of five players each. The five players of generation 1 are endowed with N$50 each, while only N$25 is allocated to the endowment of each player in the second generation. Generation 1 players are faced with a dilemma: they can choose between two options to increase the Generation 2 endowment to N$ 50. They can opt for an individual solution in which only one Generation 2 player receives N$ 50, or they can pursue a collective solution in which all Generation 2 players receive N$ 50. To opt for the individual solution, the participants of the first generation must invest N$ 20 (or N$ 25) of their endowment and can keep the rest. In the collective solution, a collective threshold of N$ 100 must be reached in order to increase the Generation 2 endowment. For a fair solution, each Generation 1 player would have to invest N$ 20 in the group account. Players can also decide to keep their entire endowment. Players of generation 2 must decide how they want to donate their endowment. They can either donate their money to a local kindergarten, contribute to a community development project or keep it for their own consumption. At the end of the workshop day, the share of individual endowments which was not invested or donated is paid out to the participants in addition to a participation fee. Donated money is paid out to the local kindergarten or community head afterwards. The game is played four times at each research location, with communication allowed in the last round. Additional variations of the game design are implemented at site and group level, which are not further specified in this paper. The game protocol can be found in Appendix C.3.

2.1.3 Workshop Design

After the game, a debriefing session and a subsequent Future Thinking Workshop (FTW) are conducted to initiate community-led climate change adaptation initiatives and to facilitate the development of a shared vision for the respective communities. In addition to the debriefing session, the workshop invites participants to envision the future of their community given the

potential for change. Communities are then asked to design prototypes that illustrate their strategies for realizing their vision of the future. Eight months later, progress in implementing the tasks is reviewed by telephone. The protocol of the FTW can be found in Appendix C.4.

2.1.4 Questionnaires

During the workshop day, we conducted two separate interviews: a general individual survey with each participant (N=511), and a learning outcome interview with a subsample of participants (N=291).

Whereas the general-individual survey mainly comprises socio-economic questions, the learning outcome interview focuses on questions about variables of interest for experiential learning. These include questions on individual awareness of the effects of climate change, attachment to place of residence and likelihood of migration, demand for information on the effects of climate change and possible adaptation strategies, intergenerational justice and empathy towards future generations, environmental self-efficacy and future prosperity prospects.

In addition to general socio-demographic information such as gender, marital status, highest level of education, source of individual income and number of children in the household, the general individual survey also asked about the participants' role in the community, the trust towards community members and their previous involvement in protecting themselves, their families or their community from floods and droughts in the past year. These variables are used in this study to account for any differences between participants that could potentially influence the outcome variables. Questionnaires can be found in Appendix C.

In the follow-up telephone surveys conducted in January and February 2024, questions are asked about the progress made in implementing the village prototypes, in particular whether the community has succeeded in designing a prototype and what major challenges it has encountered.

2.1.5 Sampling

The study was conducted in 26 communities These sites are spread across three constituencies in the Zambezi Region: Kongola, Sibbinda, and Katima Rural. The sample represents the Lozi ethnic group, whose members speak the Silozi language and reside predominantly in Zambia and

Namibia with a total population of approximately 900,000. To acknowledge for differences in language and culture within the Lozi ethnic group, only villages belonging to the Mafwe cultural community are included in our sample.

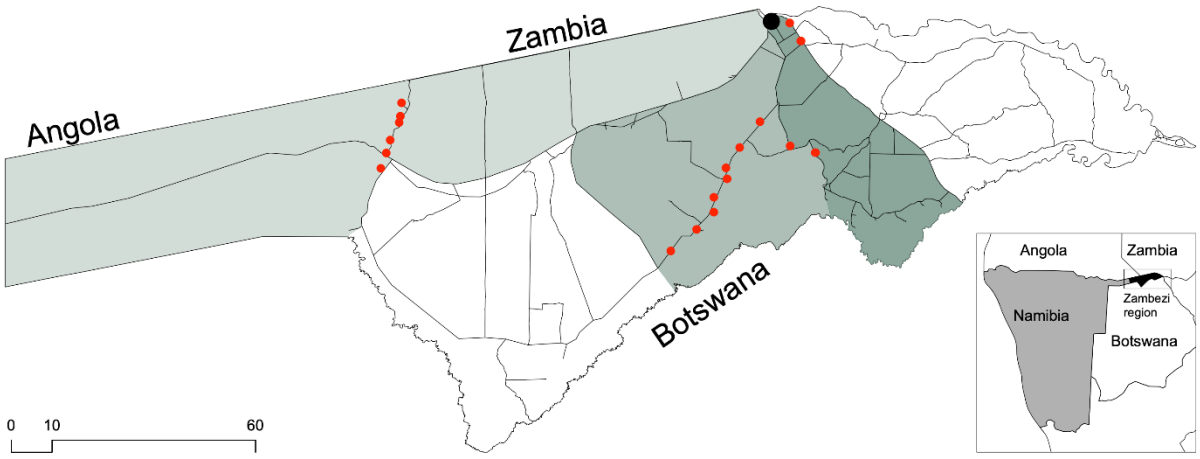


Figure 1: Map of study area in the Zambezi-region. The red points represent the sample communities, while the various green shaded areas depict the three constituencies (from left to right): Kongola, Sibbinda and Katima Rural (map edited by Valentina Mayer-Steudte).

The site selection process involves random sampling from all villages in the constituencies. Peri-urban sites are excluded due to the economic, social, and ecological differences between living conditions in urban and rural areas. As seen in Figure 1, the selected sites are located on roads, which is because roads are the most important means of transportation to reach the villages in the region. Personal contact with village leaders were initiated 2-3 days prior to visits, with confirmations formalized through phone communication. Turning to participant selection, we prioritize inclusivity by selecting influential individuals within each village through the village leader, ensuring a well-balanced representation of both men and women. At each of the 26 sites, 20 community members actively participate in both the IGAG and the FTW. Sample selection can be found in Appendix A (Table A1).

Based on the evaluation framework for social learning (Haug et al., 2011), we collected direct feedback through pre- and post-surveys in terms of learning outcome measures. This is in line with previous research that used pre-and post-survey methods for evaluating learning effects in

behavioural games (Baird et al., 2014). Given the two interventions in this study, we conducted four learning outcome surveys each: before the game (pre; n=97), after the game and before the visioning workshop (mid; n=95), and after the visioning workshop (post; n=99). The participants have been randomly assigned to the learning outcome survey and the time of the interview. For the first two sites, only six learning outcome interviews were conducted per site. From the third site onwards, a subsample of eight interviews per site was taken; four interviews were missing. Among the 296 interviews, five could not be assigned to a specific interview time and are unsuitable for the following analysis. The data set comprises 291 observations for the experiential learning outcomes analysis.

The balance table of the participants indicates differences in terms of marital status, level of education and the action taken in the last year to mitigate floods or droughts at different survey times (pre, mid, and post). Participants interviewed after the game and before the workshop were less likely to be married in comparison but reported taking more actions to protect against floods or droughts in the past year. Participants interviewed after the workshop have a lower level of education in comparison, or a higher level of low education. However, the selection of participants for the outcome learning survey, as well as the allocation of participants to the interview times, was random. This means that all differences that occur must have arisen by chance. Furthermore, we account for significant control variables in our model. Balance table of the control variables derived from the general-individual questionnaire can be found in Appendix B (Table B2).

2.2 Methods of Data Analysis

2.2.1 Learning Outcome Measures

The learning outcomes interview includes items designed to create indices that measure experiential learning outcomes. Using PCA allows us to condense the complexity of our data while preserving its essential insights, facilitating a clearer understanding of the underlying patterns and relationships. Consequently, we have applied this methodology to three indices where each variable within on index belongs to the same conceptual framework. To construct the following PCA, we were using a collection of Likert-scale items measuring participants' awareness of the

risks associated with climate change (H1), their attachment to the local area (H2), and their perceived self-efficacy in protecting their community from the effects of climate change (H5).

To assess the perceived risk associated with climate change, we use a PCA with four items. This analysis identifies a principal component that accounts for about 31% of the variance in the items and loads positively on all four indicators. Similarly, place attachment is assessed by a PCA with three items, identifying a dominant component that explains 62% of the variance in the data. A PCA with nine items is used to measure participants' perceived self-efficacy. This shows a principal component explaining 27% of the variance, with positive loadings on eight items and a slightly negative loading on one item. More details on eigenvalues and cumulative loadings of the components from the PCA of the outcome measures and the control variables can be found in Appendix B (Table 8 and 9).

Concepts that were not assessed using a group of items, but only individual questions, were included in our model as single variables. This approach ensures that each concept is adequately represented and considered, allowing for a comprehensive understanding of the factors that play a role in our analysis. These comprise the need for information on climate change (H3), and empathy towards future generations (H4).

To evaluate the level of prosperity expectation (H6), we utilize Cantril's Self-Anchoring Scale (Kilpatrick & Cantril, 1960), a scale consisting of an 11-rung ladder. This scale, adapted from Kahneman & Deaton (2010), assesses respondents' perception of their economic situation. Choosing a higher rung on the ladder signifies a more positive perceived economic condition. In order to measure the differences between the current economic situation and the future economic situation we calculated differences between the variables.

2.2.2 Statistical Analysis

We first use t-tests to compare learning outcome scores between respondents before the game (pre), between the game and the workshop (mid) and after the workshop (post). In the primary analysis of this paper, we conduct ordinary least square regression for making between-subject comparisons. Based on the scale of the variables, we employ different regression models: a simple regression model for continuous variables, a logistic regression model for binary variables, and an

ordinal logistic regression model for Likert-scale variables. We estimate the following model for each learning outcome variable:

$$Y_{ij} = ß_0 + ß_1 * interview_{mid} + ß_2 * interview_{post} + ß_3 * X_{ij} + \varepsilon_{it}$$

The dependent variables, denoted as Y_{ij}, represent the learning outcomes (comprising three indices and nine individual variables) for respondent i within community j. $ß_1$ represents the estimate of interest, indicating the influence of participating in the IGAG, while $ß_2$ signifies the combined impact of engaging in both the IGAG and the FTW on the targeted learning outcomes. The vector X_{ij} encompasses individual characteristics of the participants, such as gender age, marital status, level of education, natural logarithm of number of children living in the household, income index, role in community, individual trust towards community members and previous action to protect the community from the consequences of climate change.

CHAPTER 3

RESULTS

Regression results are shown in the following coefficient plots. Regression tables and additional regression models can be found in Appendix B Table 10-16.

Participation in the game and the workshop showed no impact on the risk awareness associated with climate change (Figure 2: H1; Table 10: Model 2). This result can be attributed to the fact that the participants already perceive climate change as a significant problem for current and future generations (Table 2). However, in terms of summary statistics, a slight increase for the perceived risk for future generations after participating in the IGAG and FTW can be observed (Table 2). In addition, participants perceived that climate change will be more severe for future generations after participating in the workshop (Table 13: Model 8). Nonetheless, overall, our intervention did not significantly increase awareness of the impacts of climate change as expected.

The same applies to the second hypothesis: playing an IGAG and participating in the FTW has no effect on place attachment (Figure 2: H2; Table 10: Model 4). Summary statistics show that respondents are more inclined to stay in their villages, regardless of incidence of floods or droughts. Thus, the likelihood for current and future generations to change their place of residence is low.

For measuring the information demand about climate change (Figure 2: H3a, H3b), we differentiate between two types of information: information about adaptation strategies and information about impacts of climate change. The results differ accordingly to the type of information: participating in IGAG and FTW has no effect on information demand about adaptation strategies (Figure 2: H3a; Table 10: Model 6) but increases the information demand about potential impacts about climate change (β_2= 1.137; Figure 2: H3b; Table 10: Model 8). Subsequent participation in the FTW after playing the IGAG increases this effect in both magnitude and significance.

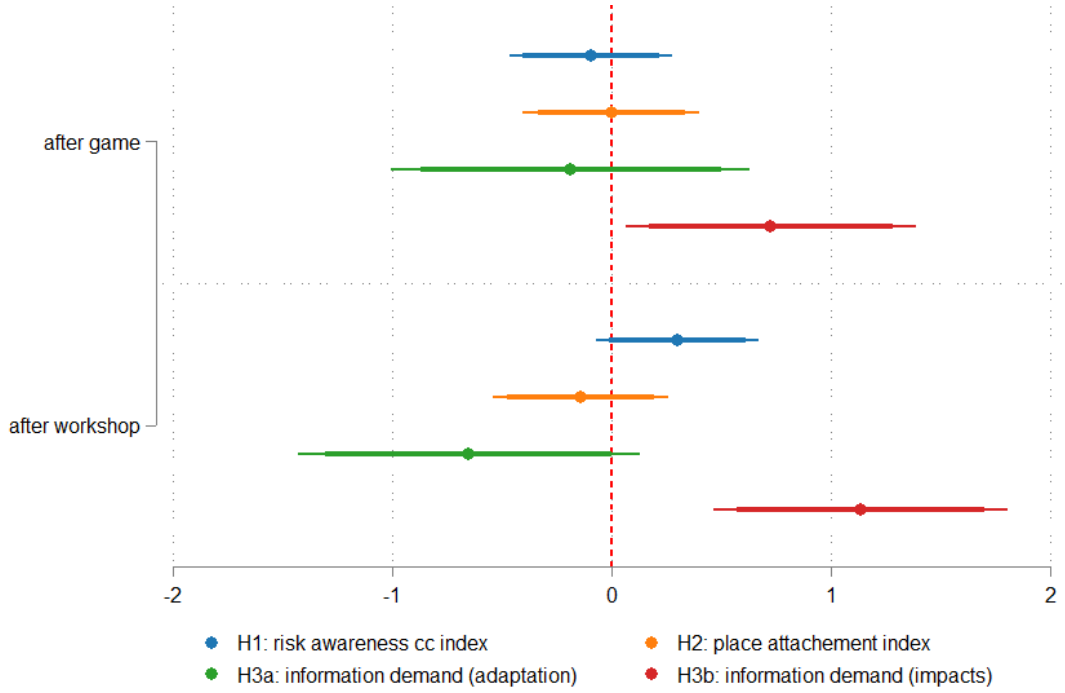


Figure 2: Coefficient plots of regression models explaining the effects of participating in IGAG and FTW on learning outcome variables (H1, H2, and H3). Thick lines indicate 10 percent significance, thin lines indicate 5 percent significance

Empathy of the participants towards future generations (Figure 3: H4a-H4d) is measured with four variables, which incorporate different conceptual ideas. After playing the IGAG and participating in the FTW, there is no observable effect on the empathy towards future generations (Figure 3: H4a; Table 11: Model 10) and the ability to imagine future generations (Figure 3: H4b; Table 11: Model 12). However, summary statistics show that empathy towards future generations and the ability to imagine future generations are already high overall (Median: 5=totally agree), and therefore challenging to increase through our intervention. However, playing the IGAG and participating in the FTW decreased the importance for today's generation to receive social approval from future generations, i.e. increased the wish for social approval of today's generation compared to the future generation (β_2= -0.812; Figure 3: H4c; Table 11: Model 14). Further, we can observe a change in focus to immediate concerns rather than future ones (β_2= -0.922; Figure 3: H4d; Table 11: Model 16).

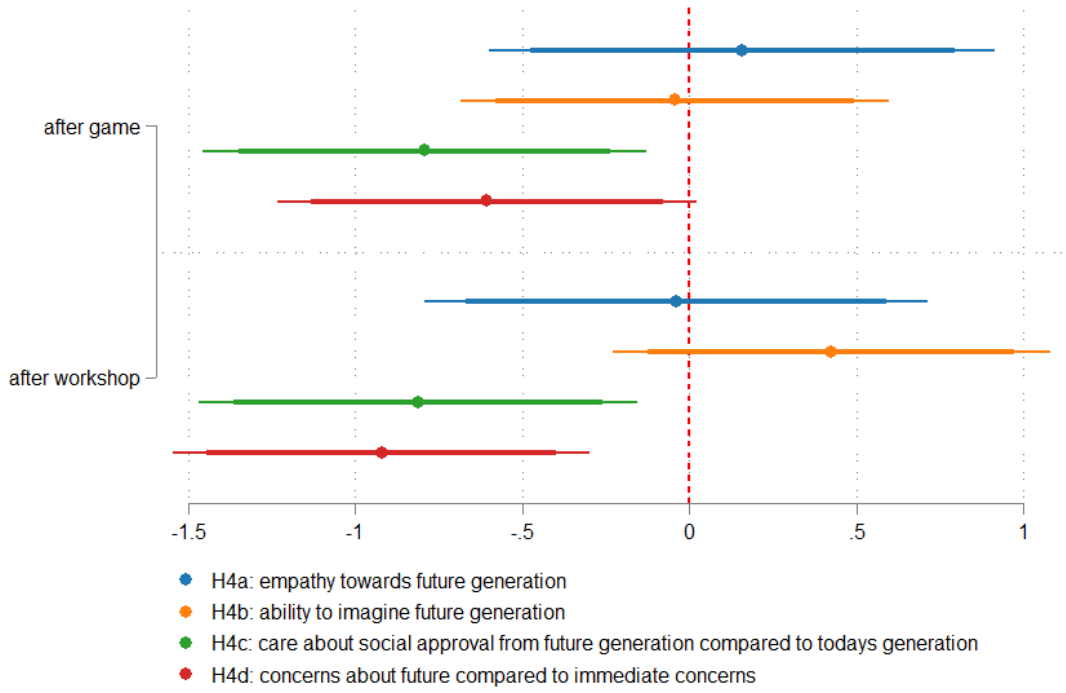


Figure 3: Coefficient plots of regression models explaining the effects of participating in IGAG and FTW on learning outcome variables (H4). Thick lines indicate 10 percent significance, thin lines indicate 5 percent significance

Participants perceived self-efficacy, expressing the capacity to influence the community's future, can be enhanced by playing a game and participating in a visioning workshop (β_2= 0.979; Figure 3: H5; Table 12: Model 18). Concerns of participants such as time constraints on environmental protection, economic uncertainty, and doubts about the ability of individuals to effect change are considered as minor components in the PCA. Additional models that include the variables individually and not as part of the index further support the increase of self-efficacy on a statistically significant level: the individual's awareness that current decisions have an impact on future generations are strengthened by the IGAG and FTW (β_2= 1.066; Table 14: Model 16). Further, participation in IGAG and FTW leads to an increase of participants perceived acquisition of sufficient knowledge (β_2= 0.841; Table 15: Model 18) and skills (β_2= 0.945; Table 15: Model 24) as well as the perception that the participants have the opportunity to protect the community against climate change (β_2= 01.397; Table 15: Model 22).

Results regarding the last hypothesis (H6) show that the workshop especially influenced perception of own future welfare compared to situation today (β_2= 0.753; Figure 4: H6a; Table 12:

Model 20). However, the IGAG and FTW have no influence on perception of welfare changes of own children or future generation in general.

Finally, from the follow-up telephone surveys conducted in January and February 2024 we know, that 19 percent of communities developed ideas for further community development after the intervention. These ideas include diverse topics such as gardening, beekeeping, the establishment of kindergartens, orchards, and clinics.

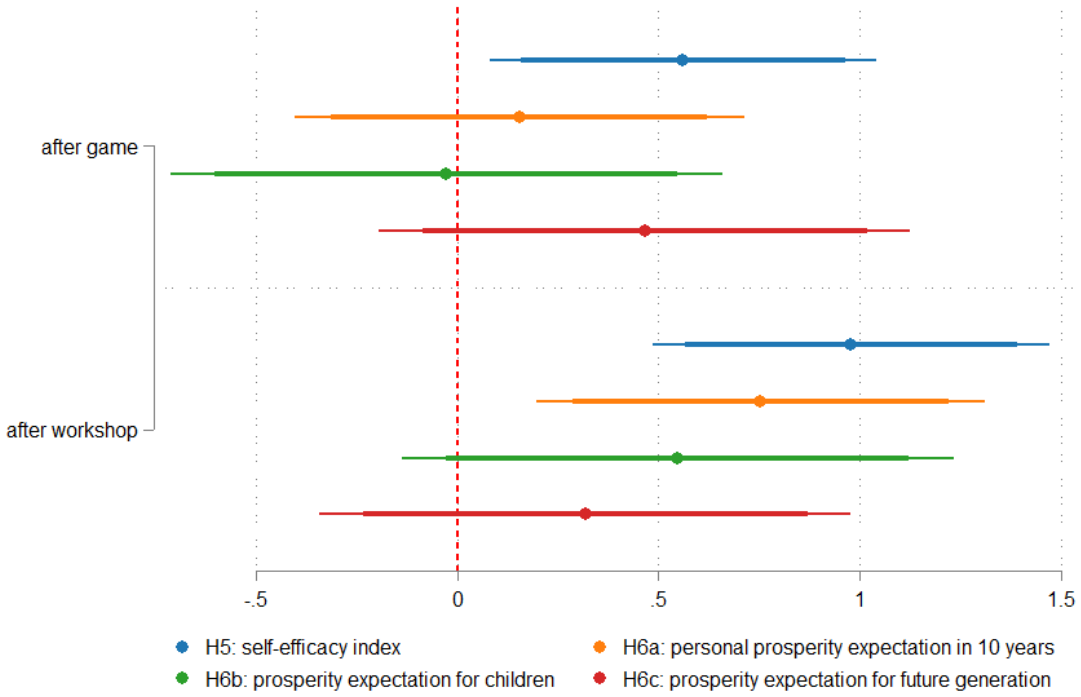


Figure 4: Coefficient plots of regression models explaining the effects of participating in IGAG and FTW on learning outcome variables (H5 and H6). Thick lines indicate 10 percent significance, thin lines indicate 5 percent significance

CHAPTER 4

DISCUSSION

The analysis of the learning outcome measures points in two different directions: 1) playing the game and participating in the visioning workshop increased participants' perceived self-efficacy to take action against the consequences of climate change; 2) we observed no or negative effects on the relationship with future generations and no significant increase in awareness of the intergenerational social dilemma. Since these results deviate from our expectations and hypotheses, we discuss them along the following three implications: (1) collective action today for the future, (2) social distance and intergenerational discounting, (3) and the potential of environmental efficacy leading to lasting behavior change.

Collective action today for the future

Our intervention emphasized collective thinking and enabled participants to understand the collective action needed to protect their community from the effects of climate change in the future. The individual's awareness that current decisions have an impact on future generations and that individual actions can influence the environment are strengthened by the IGAG and FTW (H5). On the other side, we could not observe an increase in risk awareness towards the implications of climate change (H1).

However, no effect on perceived risk awareness towards climate change does not indicate that the participants fundamentally underestimate the consequences of climate change. When asked which natural disasters they think will occur more frequently in the next 20 years, the participants' perceptions are in line with the findings of Hughes & Farinosi (2020): they expect an increased occurrence of heat (93%), droughts (94%), fires (91%) and soil erosion (92%) (Appendix B: Table 5). Furthermore, climate change is one of the top three concerns of people in the village community. It ranks second as the primary challenge for both the current and future generation within the village community, after poverty for the current generation and unemployment for the future generation (Appendix B: Table 6).

As climate change is multi-faceted, complex, and characterized by considerable uncertainty, it contributes to participants' heightened interest in learning about the impacts of climate change resulting from participating in the IGAG and FTW prior to considering potential adaptation strategies. Consequently, participants may prioritize understanding the potential impacts as a preliminary step to developing collective coping strategies (H3). Recognizing climate change as a significant challenge for current and future generations offers a promising way to promote climate change adaptation initiatives at the community level. Additionally, by tackling challenges like poverty and unemployment, communities can further enhance their resilience to adapt to the consequences of climate change.

By fostering collective engagement to protect the community from climate change through participation in the IGAG and FTW, we may have strengthened relationships between community members, families, and friends. This effect exceeds the expectation that a reduction in place attachment would occur due to increased risk awareness of climate change impacts. Since our sample consists entirely of rural communities and the existing literature suggests that residents of rural areas tend to have a stronger attachment to their place of residence (Lie et al., 2023; Tenbrink & Willcock, 2023), we assume that participants already have a relatively strong attachment to their place of residence. This could explain why no change in place attachment can be observed (H2).

Social distance and intergenerational discounting

Social distance and intergenerational discounting play a crucial role in the specific game concept of the IGAG, which integrates elements from the basic structure of the dictator game and the public goods games. dictator games inherently favor the strongest individual payoff when resources are not shared with future generations, which can explain the lack of or negative impact on the relationship with future generations after playing the IGAG (H4, H6). From a rational perspective, the individual exploitation of resources is favored and thus underpins the dominance of the present generation in decision-making power. Moreover, in dictator games, the social distance to the recipient significantly influences the proposer’s decision. When proposers in the game are anonymous to the recipient, resulting in a considerable social distance, they usually allocate a smaller portion of the endowment. Conversely, when players have a closer relationship, they tend to allocate a larger proportion of the endowment (Hoffman et al., 1996).

The ability to empathize with another situation and to adopt an unfamiliar perspective faces several challenges, including complexity and the uncertain nature of the future, insufficient capacity due to existential priorities and a long-term time horizon. Thus, we assume that the social distance between the current and future generation is high, which can explain that we observed no or negative effects on the relationship with future generations and no significant increase in awareness of the intergenerational social dilemma. Participants rather tend to prioritize immediate concerns over future considerations more and focus on how they are perceived by their current environment after the intervention (H4). Additionally, our intervention influenced individuals' perceptions of their own future well-being in relation to the current situation but did not extend to altering their views on the well-being of their children or future generations (H6). These results visualize the problem of intergenerational discounting and prove to be a major hurdle in connection with behavioral change in the context of climate change.

Furthermore, the question arises as to the extent of social distancing between the members of the community within the experimental game situation itself. In a dictator game conducted in rural Mexican communities to assess the effects of social distancing, Candelo et al. (2018) confirmed that participants showed a greater tendency to contribute to family members than community members and strangers. They also found that there was no significant difference in contributions between community members and strangers. In relation to our research, these findings suggest that social distance to community members may be too great to overcome self-interested preferences. This assumption is also supported by descriptive statistics drawn from the general individual survey, in which 92% of participants indicated that they either trusted no one or only few members of the community (see descriptive statistics Appendix B Table 7).

Environmental efficacy & medium-term behavioural change

The significant impact on self-efficacy acts as a catalyst, prompting individuals to demonstrate their own initiative. Collective action within communities is essential, particularly in the area of environmental protection, and is encouraged by increasing self-efficacy. This is particularly important when communities find themselves dependent on external help. From our general-individual survey, we know that almost half of the participants believe that the responsibility to address climate change lies with external actors, such as organizations and the government

(Appendix B: Table 4). Increasing self-efficacy suggests that this perceived dependency can be overcome, and community members can be encouraged to take action themselves.

Having recognized the significant role of self-efficacy as a primary driver of behavior change, we are optimistic that it can bring about sustainable change towards medium-term environmental protection. Building on this understanding, at the end of our visioning workshop we encouraged communities to collectively develop ideas how to contribute to achieving their visions discussed in the visioning workshop and thus strengthen their commitment to lasting change. To date, limited research has been conducted on the effects of behavioral games on medium-term behavioral change. Meinzen-Dick et al. (2018) showed that repeating the game two years after the initial intervention led to improved cooperation. In addition, communities that participated in the groundwater game showed greater adoption of institutional rules compared to their counterparts. In contrast, Falk et al. (2019) did not observe improved cooperation in the Indian district of Bhilwara when the game was repeated 20 months after the first intervention. As part of our research, we have encouraged about one fifth of the communities to develop strategies in the form of prototypes to realize their community visions eight months after our intervention. By demonstrating that the impact of our intervention extends beyond our presence on the ground, we make a valuable contribution to research on medium-term behavior change through experiential learning, but clearly point to the need for future research.

CHAPTER 5

CONCLUSIONS

As part of this research, we aimed to illustrate to participants the potential impact of the current generation's actions on future generations in the context of climate change and the potential of collective action. To achieve this, the participants were engaged in a game scenario that focused on intergenerational equity and the strategies developed by the community to adapt to climate change. The research day in each of the 26 communities in the Zambezi-region in Namibia was then concluded with a debriefing session and visioning workshop. This experiential approach enables participants to transfer their experiences from the game to real-life contexts and thus facilitate experience-based learning.

Overall, the study confirms the effectiveness of the experiential learning approach. We observe that attitudes and mental frameworks are changing and, more importantly, we have been able to stimulate participants' own initiative to protect their communities from the impacts of climate change. In summary, our results indicate a significant increase in self-efficacy after our experiential learning intervention, as well as an increased need for information regarding the potential impacts of climate change. Unexpectedly, there was no noticeable effect on increasing awareness of the risks of climate change or reducing place attachment. Furthermore, we found no evidence that our intervention strengthened participants' relationships with future generations or increased awareness of the multigenerational dilemma. Instead, participants tended to prioritize immediate concerns over future considerations and focused more on how they were perceived by their current environment after the intervention. Furthermore, our intervention only influenced the perception of one's own future well-being compared to the current situation, but not the perception of the well-being of one's children or future generations.

The findings observed in the study can be explained by considering a variety of contributing factors. First, we emphasized the importance of collective thinking in addressing the impacts of climate change and fostered participants' understanding of the need for collective action in the intervention, which serve as an explanation for an increase in self-efficacy and knowledge demand.

Second, the unique game design combines elements of the dictator game and the public goods game, reinforcing the preference for individual resource use and thus the dominance of the current generation in decision-making power. In addition, social distancing and intergenerational discounting influenced participants to prioritize immediate concerns over future considerations, complicating efforts to address climate change. Nonetheless, the increased self-efficacy encouraged the community to take initiative-taking steps that could potentially create lasting and sustainable change in communities.

The confirmation of the effectiveness of the experiential learning approach may be attributed in part to specific elements built into the game design that have been shown in previous research on experiential learning in behavioral games to improve experiential learning outcomes. For example, we allowed communication in the final round, introduced a debriefing and vision workshop to improve participant engagement, introduced an incentivized payment structure, incorporated an open discussion, and linked the game experience to real-life scenarios in the Zambezi region. However, by its very nature, research conducted in the field takes place in an uncontrolled environment where the influence of culture and traditions can significantly affect the results. In addition, the study was conducted in a small setting that allowed only a limited number of observations. Consequently, future studies on a larger scale could provide a more comprehensive understanding of experiential learning and can give the possibility to investigate long-term effects of behavioral games on real-life behavior and institutional change. By implementing behavioral games on a large scale and at minimal cost, we can advance the development of experiential learning as a powerful tool in the field of development work.

This research approach has the potential to contribute significantly to sustainable transformation initiatives through the effective use of experiential learning methods. It not only enriches our understanding of the mechanisms that drive behavior change, but also highlights the practical implications of integrating experiential learning into broader development strategies aimed at promoting lasting positive change in society and ultimately benefits future generations and our environment.

APPENDIX A

STUDY AREA AND SAMPLE

Table 1: Sample selection categorized in constituencies; site-IDs in brackets

Kongola Constituency	*Sibbinda Constituency*	*Katima Rural Constituency*
Kongola (1)	Lusu (10)	Namalubi (20)
Kalubi (2)	Masokotwani (11)	Mubiza (21)
Sikaunga (3)	Mazoba (12)	Liselo (22)
Izwi (4)	Makolonga (13)	Gunkwe (23)
Singalamwe (5)	Kanono (14)	Kalumba (24)
Mwanzi (6)	Muketela (15)	Machita (25)
Kawuyo (7)	Kisako (16)	Kwena (26)
Muchimbami (8)	Malundu(17)	
Kapako (9)	Shaile (18)	
	Chinchimani (19)	

APPENDIX B

RESEARCH METHODS

1. Summary statistics and additional descriptive statistics

Table 2: Summary statistics of all learning outcome variables (Mean, Percentage, Median)

		Mean / in% / Median			Pairwise t-test: Mean difference		
No.	**Variables**	(1)	(2)	(3)	(1)-(2)	(1)-(3)	(2)-(3)
1	challenge: cc today (in percent)	64%	59%	62%	0.05	0	-0.05
2	challenge: cc future (in percent)	46 %	43%	60%	0.03	-0.14**	-0.17**
3	severity: cc today (median)	5	5	5	-0.08	-0.01	0.06
4	severity: cc future (median)	5	5	5	-0.06	-0.10	-0.03
5	PCA: risk perception cc (mean)	0.16	0.02	-0.11	0.14	0.27	0.13
6	relocation likelihood today (median)	1	1	1	-0.22	0.16	0.38*
7	relocation likelihood future (median)	2	1	1	0.14	0.21	0.07
8	life in urban area (median)	4	4	4	-0.02	0.11	0.14
9	PCA: place attachment (mean)	0.05	0.10	-0.13	-0.04	0.18	0.22
10	information demand: adaptation (median)	5	5	5	0.03	0.13*	0.10
11	information demand: impact cc (median)	4	4	5	-0.17**	-0.26***	-0.08
12	empathy towards future generation (median)	5	5	5	-0.03	-0.00	0.02
13	ability to imagine future generation (median)	5	5	5	-0.00	-0.11	-0.11
14	care about social approval from future generation (median)	3	3	3	0.22**	0.23**	0.00
15	consideration of future generation (median)	5	4	3	0.13	0.42***	0.29**
16	self-efficacy: impact (median)	4	4	5	-0.21**	-0.28***	-0.07
17	self-efficacy: knowledge (median)	4	4	4	-0.20*	-0.33***	-0.13
18	self-efficacy: ability (median)	5	5	5	-0.06	-0.10	-0.05
19	self-efficacy: opportunity (median)	3	4	4	-0.30**	-0.65***	-0.35***
20	self-efficacy: skill (median)	4	4	4	-0.13	-0.42***	-0.28**
21	self-efficacy: individual action (median)	3	3	2	-0.05	0.27	0.32
22	self-efficacy: no influence (median)	3	3	4	-0.02	-0.30*	-0.28
23	self-efficacy: no money (median)	2	2	2	-0.12	0.09	0.21
24	self-efficacy: no time (median)	1	2	2	-0.08	-0.24**	-0.16
25	PCA: self-efficacy (mean)	-0.52	0.10	0.53	-0.62***	-1.05***	-0.43*
26	ladder of life: 10 years-today (mean)	3.20	3.28	3.89	-0.08	-0.69**	-0.61**
27	ladder of life: children-today (mean)	4.46	4.49	5.20	-0.03	-0.74**	-0.71**
28	ladder of life: future generation-today (mean)	4.72	5.21	5.22	-0.49	-0.50	-0.01

Table 3: Balance table of control variables derived from general individual survey

	Mean/(SE)						Pairwise t-test: Mean difference					
Variable	pre (1)		mid (2)		post (3)		'(1)-(2)		(1)-(3)		(2)-(3)	
	(1)	N	(2)	N	(3)	N		N		N		N
gender (1=female)	0.57	93	0.59	95	0.55	95	-0.02	188	0.02	188	0.04	190
	(0.05)		(0.05)		(0.05)							
age: youth (18-24)	0.12	93	0.10	94	0.11	94	0.02	187	0.01	187	-0.01	188
	(0.03)		(0.03)		(0.03)							
age: young adults (25-34)	0.34	93	0.32	94	0.33	94	0.02	187	0.01	187	-0.01	188
	(0.05)		(0.05)		(0.05)							
age: adults (35-64)	0.49	93	0.54	94	0.49	94	-0.05	187	0.01	187	0.05	188
	(0.05)		(0.05)		(0.05)							
age: older adults (+65)	0.04	93	0.04	94	0.07	94	0.00	187	-0.03	187	-0.03	188
	(0.02)		(0.02)		(0.03)							
marital status (1=married)	0.41	93	0.23	95	0.39	93	0.18***	188	0.02	186	-0.16**	188
	(0.05)		(0.04)		(0.05)							
low education level	0.08	92	0.04	95	0.15	94	0.03	187	-0.07	186	-0.11**	189
	(0.03)		(0.02)		(0.04)							
medium education level	0.76	92	0.84	95	0.76	94	-0.08	187	0.01	186	0.09	189
	(0.04)		(0.04)		(0.04)							
high education level	0.16	92	0.12	95	0.10	94	0.05	187	0.07	186	0.02	189
	(0.04)		(0.03)		(0.03)							
(number of children in the hh+1)log	1.28	92	1.34	91	1.35	91	-0.06	183	-0.07	183	-0.01	182
	(0.04)		(0.05)		(0.05)							
income index	-0.19	91	-0.04	95	0.02	95	-0.15	186	-0.21	186	-0.05	190
	(0.12)		(0.12)		(0.12)							
leader in community	0.31	88	0.27	92	0.33	92	0.04	180	-0.02	180	-0.05	184
	(0.05)		(0.05)		(0.05)							
no trust in community members	0.12	93	0.09	95	0.06	95	0.02	188	0.06	188	0.03	190
	(0.03)		(0.03)		(0.03)							
very few trust in community members	0.78	93	0.83	95	0.84	95	-0.05	188	-0.06	188	-0.01	190
	(0.04)		(0.04)		(0.04)							
trust in more than half of com. members	0.05	93	0.06	95	0.05	95	-0.01	188	0.00	188	0.01	190
	(0.02)		(0.03)		(0.02)							
trust in almost every one of com. members	0.04	93	0.01	95	0.04	95	0.03	188	0.00	188	-0.03	190
	(0.02)		(0.01)		(0.02)							
actions to protect against floods / droughts last year	0.43	93	0.61	90	0.40	94	-0.18**	183	0.03	187	0.21***	184
	(0.05)		(0.05)		(0.05)							

**Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01*

Table 4: Responsible actor to address the consequences of climate change

Responsibility to address climate change	Frequency	Percentage
Organizations / Government (extern)	246	48.71%
Both (intern / extern)	182	36.04
Individuals, family, community (intern)	77	15.25%
Total	505	100%

Table 5: Perception about change in frequency of weather events in the coming 20 years

Frequency of events in the community (coming 20 years)	Less frequent Frequency	Percentage	More frequent Frequency	Percentage	N
Floods	97	43%	129	57%	226
Heat	17	6%	252	93%	269
Rain	71	34%	137	66%	208
Droughts	18	6%	263	94%	281
Storms	114	49%	119	51%	233
Fires	23	9%	223	91%	246
Soil erosion	20	8%	229	92%	249

Table 6: Main challenges for the community today and in 20 years

	Challenges Today	in %	Mean	SD.		***Challenges in 20 years***	in %	Mean	SD
1	poverty	85%	0.8547	0.3525	1	unemployment	63%	0.6250	0.4843
2	climate	61%	0.6149	0.4868	2	climate	51%	0.5068	0.5002
3	unemployment	35%	0.3480	0.4765	3	poverty	45%	0.4493	0.4976
4	electricity	26%	0.2635	0.4407	4	health	32%	0.3209	0.4670
5	crime	21%	0.2128	0.4095	5	corruption	32%	0.3176	0.4657
6	health	21%	0.2061	0.4047	6	crime	30%	0.3007	0.4587
7	land use	16%	0.1622	0.3688	7	youth crimes	25%	0.2500	0.4332
8	economy	12%	0.1182	0.3234	8	economy	17%	0.1723	0.3772
9	corruption	12%	0.1182	0.3230	9	land use	16%	0.1588	0.3656
10	youth crimes	8%	0.0811	0.2731	10	child abuse	5%	0.0507	0.2194

Table 7: Degree of trust towards community members

Trustworthy people living in this community	Frequency	Percentage	Cum.
No One	40	7.83	7.83
Very Few	431	84.34	92.17
More than half	26	5.09	97.26
Almost Everyone	14	2.74	100
Total	511	100	

2. Learning outcome measures

Table 8: Loadings of first component of each item

Description	Questionnaire survey	Component1
risk awareness cc index		
challenge: cc today	What do you consider for people in your village to be the three most serious problems today?	0.5264
challenge: cc future	What do you consider will be the three most serious problems for the people living in your village in 20 years?	0.4685
severity: cc today	How serious is the threat of climate change to you personally?	0.4826
severity: cc future	How serious is the threat of climate change to the next generation?	0.5201
place attachment index		
relocation likelihood today	How likely do you think it is that you have to relocate permanently from your current location, due to more frequent floods or droughts?	0.6725
relocation likelihood future	How likely do you think it is that future generations have to relocate permanently from their current location, due to floods and/or droughts?	0.6729
life in urban area	I can imagine a good life somewhere else such as in an urban area?	0.3082
self-efficacy index		
impact	I understand the impact my decisions can have on future generations.	0.4255
knowledge	I know how I can contribute to protect my community against the implications of Climate Change.	0.4331
ability	With dedication and hard work, I am able to contribute to protect my community against the implications of Climate Change.	0.3965
opportunity	There are many opportunities for me to protect my community against the implications of Climate Change.	0.5185
skill	I am confident that I have the necessary skills to protect my community against the implications of Climate Change.	0.4391
individual action	My individual actions can make a difference to the environment.	0.0729
no influence	I am only one person, I can't make a difference to the environment.	-0.0005
no money	My economic situation does not allow me to protect the environment.	0.0761
no time	I don't have time to protect the environment.	0.0374
income index	What are the sources of income and/or subsistence for your household?	
employed	wage labor, farm wage labor, salary	-0.7531
farming	Irrigated farming, rainfed farming, animal husbandry	0.598
business	business	0.1738
remittances	remittances	0.2121

Table 9: Eigenvalue, Differences, Proportion and Cumulative of each PCA

Component	Eigenvalue	Difference	Proportion	Cumulative
risk awareness cc index				
Comp1	1.46872	0.541356	0.3672	0.3672
Comp2	0.927363	0.0687351	0.2318	0.599
Comp3	0.858628	0.113339	0.2147	0.8137
Comp4	0.745289	.	0.1863	1
place attachment index				
Comp1	1.86421	0.954883	0.6214	0.6214
Comp2	0.909328	0.682867	0.3031	0.9245
Comp3	0.226461	.	0.0755	1
self-efficacy index				
Comp1	2.45677	0.74845	0.273	0.273
Comp2	1.70832	0.328228	0.1898	0.4628
Comp3	1.38009	0.513155	0.1533	0.6161
Comp4	0.866932	0.192215	0.0963	0.7125
Comp5	0.674717	0.0630152	0.075	0.7874
Comp6	0.611702	0.0921679	0.068	0.8554
Comp7	0.519534	0.11865	0.0577	0.9131
Comp8	0.400884	0.0198236	0.0445	0.9577
Comp9	0.381061	.	0.0423	1
income index				
Comp1	1.23893	0.157325	0.3097	0.3097
Comp2	1.0816	0.0599464	0.2704	0.5801
Comp3	1.02166	0.363849	0.2554	0.8355
Comp4	0.657808	.	0.1645	1

3. Regression outputs and additional analysis

Table 10: Primary regression model H1, H2, and H3

	Hypothesis 1		**Hypothesis 2**		**Hypothesis 3**			
	risk awareness cc index		place attachment index		information demand: adaptation		information demand: impact cc	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
after game	-0.141	-0.233	0.044	-0.002	-0.144	-0.188	0.564+	0.727*
	(0.159)	(0.174)	(0.199)	(0.204)	(0.363)	(0.417)	(0.296)	(0.339)
after workshop	-0.273+	-0.17	-0.179	-0.138	-0.630+	-0.651	0.888**	1.137***
	(0.158)	(0.174)	(0.197)	(0.203)	(0.341)	(0.397)	(0.295)	(0.343)
gender		0.179		-0.279		0.118		-0.509+
		(0.153)		(0.18)		(0.354)		(0.296)
age		0.257*		-		0.439+		-0.007
		(0.106)		(0.125)		(0.247)		(0.206)
marital status		0.02		-0.246		-0.061		0.050
		(0.168)		(0.197)		(0.382)		(0.325)
highest education		0.141*		0.104		-0.076		-0.076
		(0.063)		(0.074)		(0.143)		(0.124)
leader in community		0.088		-0.281		0.102		0.177
		(0.171)		(0.2)		(0.392)		(0.328)
(# of children in hh+1)log		0.378*		-0.097		0.136		0.249
		(0.16)		(0.188)		(0.378)		(0.310)
income index		-0.141*		0.068		0.038		-0.103
		(0.064)		(0.076)		(0.146)		(0.124)
trust in com.		0.046		-0.232		-0.630+		-0.674*
		(0.144)		(0.169)		(0.324)		(0.294)
previous activity for cc protection		0.005		-0.121		0.040		0.265
		(0.148)		(0.173)		(0.339)		(0.285)
_cons	0.163	-1.811***	0.053	1.709**				
	(0.112)	(0.506)	(0.14)	(0.596)				
cut1 cons					-5.954***	-3.903**	-5.235***	-5.197***
					(1.028)	(1.199)	(1.012)	(1.215)
cut2 cons					-4.143***	-1.238	-4.126***	-0.039
					(0.472)	(1.117)	(0.598)	(0.996)
cut3 cons					-1.447***		0.630**	
					(0.262)		(0.216)	
N	290	252	289	252	286	248	287	250
adj. R^2	0.003	0.046	-0.002	0.131				

*Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 11: Primary regression model H4

	Hypothesis 4							
	empathy towards future generation		ability to imagine future generation		care about social approval from future generation compared to today's generation		concerns about future compared to immediate concerns	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
after game	0.183	0.157	0.024	-0.044	-0.621*	-0.793*	-0.309	-0.606+
	(0.338)	(0.386)	(0.287)	(0.326)	(0.289)	(0.338)	(0.280)	(0.320)
after workshop	-0.025	-0.040	0.418	0.424	-0.680*	-0.812*	-0.804**	-0.922**
	(0.324)	(0.384)	(0.289)	(0.334)	(0.290)	(0.336)	(0.279)	(0.318)
gender		-0.224		-0.502+		-0.129		0.118
		(0.343)		(0.293)		(0.299)		(0.280)
age		0.370		0.164		0.645**		0.512**
		(0.235)		(0.200)		(0.213)		(0.196)
marital status		-0.110		0.065		-0.049		0.108
		(0.375)		(0.326)		(0.327)		(0.302)
highest education		-0.258+		-0.062		-0.080		-0.087
		(0.154)		(0.125)		(0.122)		(0.115)
leader in community		0.360		0.452		-0.317		-0.106
		(0.392)		(0.338)		(0.339)		(0.306)
(# of children in hh+1)log		-0.153		0.086		0.167		-0.059
		(0.358)		(0.302)		(0.314)		(0.296)
income index		-0.213		-0.062		-0.143		-0.122
		(0.147)		(0.121)		(0.128)		(0.115)
trust in com.		-0.294		-0.211		-0.268		-0.479+
		(0.311)		(0.274)		(0.277)		(0.280)
previous activity for cc protection		0.101		0.374		-0.152		0.114
		(0.330)		(0.282)		(0.290)		(0.268)
cut1 cons	-4.513***	-5.639***	-3.727***	-3.622***	-5.447***	-5.257***	-4.130***	-3.904***
	(0.610)	(1.355)	(0.442)	(1.045)	(0.734)	(1.410)	(0.425)	(1.008)
cut2 cons	-3.810***	-4.934***	-0.150	-0.120	0.153	1.141	-3.663***	-3.606***
	(0.453)	(1.259)	(0.202)	(0.975)	(0.195)	(1.003)	(0.359)	(0.987)
cut3 cons	-1.059***	-1.931+			1.226***	2.190*	-0.415*	-0.061
	(0.232)	(1.156)			(0.212)	(1.014)	(0.206)	(0.921)
N	290	252	291	253	290	252	290	252

*Notes: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Primary regression model H5 and H6

	Hypothesis 5		Hypothesis 6					
	self-efficacy index		prosperity expectation: 10 years-today		prosperity expectation: children-today		prosperity expectation: future generation-today	
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
after game	0.623**	0.561*	0.079	0.154	0.031	-0.027	0.489	0.466
	(0.221)	(0.244)	(0.274)	(0.283)	(0.318)	(0.348)	(0.309)	(0.335)
after workshop	1.052***	0.979***	0.690*	0.753**	0.738*	0.548	0.501	0.318
	(0.221)	(0.251)	(0.271)	(0.283)	(0.315)	(0.349)	(0.306)	(0.335)
gender		-0.302		-0.266		-0.115		0.022
		(0.216)		(0.251)		(0.307)		(0.296)
age		0.213		-0.879***		-0.412+		-0.179
		(0.153)		(0.173)		(0.213)		(0.205)
marital status		-0.102		-0.367		-0.649+		-0.877**
		(0.24)		(0.274)		(0.337)		(0.324)
highest education		-0.129		0.034		-0.349**		-0.395**
		(0.093)		(0.103)		(0.127)		(0.122)
leader in community		0.307		-0.15		0.389		0.284
		(0.249)		(0.278)		(0.343)		(0.33)
(# of children in hh+1)log		-0.078		0.22		0.356		0.124
		(0.23)		(0.261)		(0.321)		(0.308)
income index		-0.175+		-0.145		-0.246+		-0.069
		(0.091)		(0.105)		(0.129)		(0.124)
trust in com.		-0.282		-0.291		-0.019		0.091
		(0.205)		(0.234)		(0.289)		(0.278)
previous activity for cc protection		0.218		0.041		0.159		0.036
		(0.208)		(0.241)		(0.296)		(0.285)
_cons	-0.521***	-0.041	3.198***	5.534***	4.464***	6.802***	4.722***	7.033***
	(0.155)	(0.725)	(0.192)	(0.821)	(0.224)	(1.013)	(0.217)	(0.974)
N	272	237	288	250	291	253	291	253
adj. R^2	0.072	0.096	0.02	0.154	0.017	0.066	0.005	0.052

*Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 13: Additional Regression Models H1

	Hypothesis 1							
	challenge: cc today		challenge: cc future		severity: cc today		severity: cc future	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
after game	-0.210	-0.259	-0.131	-0.421	0.499	0.326	0.414	0.485
	(0.297)	(0.341)	(0.290)	(0.331)	(0.376)	(0.428)	(0.299)	(0.337)
after workshop	-0.012	0.048	0.575*	0.494	0.190	0.444	0.462	0.902*
	(0.297)	(0.348)	(0.289)	(0.334)	(0.350)	(0.428)	(0.298)	(0.361)
gender		-0.433		-0.574+		0.948*		0.041
		(0.303)		(0.294)		(0.382)		(0.310)
age		0.690**		0.312		0.690**		0.050
		(0.216)		(0.206)		(0.263)		(0.208)
marital status		0.127		-0.199		-0.586		0.041
		(0.337)		(0.321)		(0.426)		(0.349)
highest education		-0.043		0.017		0.169		0.218+
		(0.130)		(0.121)		(0.148)		(0.128)
leader in community		-0.274		-0.155		0.742		0.876*
		(0.344)		(0.327)		(0.480)		(0.373)
(# of children in hh+1)log		0.052		0.339		0.808*		0.192
		(0.319)		(0.305)		(0.387)		(0.318)
income index		-0.027		-0.101		-0.339*		-0.246+
		(0.127)		(0.123)		(0.166)		(0.131)
trust in com.		-0.020		-0.514+		0.201		0.118
		(0.291)		(0.279)		(0.372)		(0.290)
previous activity for cc protection		-0.228		0.489+		0.223		-0.108
		(0.292)		(0.285)		(0.369)		(0.296)
_cons	0.572**	-0.557	-0.145	-0.584				
	(0.211)	(1.009)	(0.204)	(0.967)				
cut1 cons					-5.459***	-1.239	-4.293***	-2.385*
					(1.019)	(1.518)	(0.599)	(1.132)
cut2 cons					-3.836***	0.408	-3.590***	-1.863+
					(0.487)	(1.234)	(0.438)	(1.072)
cut3 cons					-2.774***	1.432	-2.448***	-0.619
					(0.330)	(1.194)	(0.285)	(1.015)
cut3 cons					-1.239***	2.945*	-0.391+	1.406
					(0.241)	(1.199)	(0.202)	(1.008)
N	291	253	291	253	290	252	290	252

*Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 14: Additional Regression Models H2 and H5

	Hypothesis 2						Hypothesis 5	
	relocation likelihood today		relocation likelihood future		life in urban area		impact	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
after game	0.203	0.229	-0.185	-0.263	0.079	0.067	0.693*	0.792*
	(0.297)	(0.340)	(0.274)	(0.314)	(0.256)	(0.292)	(0.281)	(0.316)
after workshop	-0.187	-0.209	-0.234	-0.229	-0.054	-0.077	0.903**	1.066***
	(0.296)	(0.352)	(0.266)	(0.307)	(0.257)	(0.290)	(0.281)	(0.323)
gender		-0.523+		-		0.163		-0.251
		(0.311)		(0.286)		(0.260)		(0.281)
age		-0.684***		-0.720***		-0.666***		0.229
		(0.207)		(0.193)		(0.178)		(0.193)
marital status		-0.304		-0.343		0.219		-0.145
		(0.351)		(0.307)		(0.281)		(0.310)
highest education		0.073		0.170		0.022		-0.112
		(0.134)		(0.112)		(0.108)		(0.119)
leader in community		-0.778*		-0.377		-0.184		0.549+
		(0.384)		(0.321)		(0.288)		(0.314)
(# of children in hh+1)log		-0.054		-0.120		-0.426		-0.295
		(0.316)		(0.296)		(0.270)		(0.289)
income index		0.084		0.239*		-0.110		-0.295*
		(0.129)		(0.117)		(0.108)		(0.119)
trust in com.		-0.058		-0.323		-0.523*		-0.016
		(0.305)		(0.273)		(0.238)		(0.261)
previous activity for cc protection		0.041		-0.249		-0.121		-0.029
		(0.293)		(0.267)		(0.247)		(0.271)
cut1 cons	0.671**	-1.286	-0.071	-2.211*	-1.982***	-4.766***	-1.816***	-2.167*
	(0.210)	(1.002)	(0.194)	(0.916)	(0.231)	(0.904)	(0.242)	(0.947)
cut2 cons	0.913***	-1.025	0.502*	-	-1.085***	-3.713***	0.800***	0.579
	(0.214)	(1.001)	(0.197)	(0.911)	(0.196)	(0.882)	(0.204)	(0.939)
cut3 cons	1.165***	-0.787	0.675***	-1.441	-0.548**	-3.098***		
	(0.219)	(1.000)	(0.199)	(0.910)	(0.187)	(0.873)		
cut4 cons	2.167***	0.363	1.584***	-0.352	0.656***	-1.891*		
	(0.257)	(1.002)	(0.222)	(0.904)	(0.190)	(0.861)		
N	290	253	290	252	291	253	290	252

*Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 15: Additional Regression Models H5

	Hypothesis 5							
	knowledge		ability		opportunity		skill	
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
after game	0.681*	0.617+	0.115	-0.023	0.661*	0.659*	0.309	0.467
	(0.290)	(0.323)	(0.285)	(0.324)	(0.273)	(0.310)	(0.268)	(0.304)
after workshop	0.936**	0.841**	0.165	0.075	1.367***	1.397***	0.873**	0.945**
	(0.287)	(0.316)	(0.281)	(0.322)	(0.274)	(0.308)	(0.268)	(0.302)
gender		-0.458		-0.435		-0.109		-0.121
		(0.281)		(0.289)		(0.267)		(0.268)
age		0.217		0.394*		-0.141		-0.052
		(0.190)		(0.201)		(0.185)		(0.185)
marital status		-0.242		-0.123		0.185		0.144
		(0.310)		(0.318)		(0.294)		(0.296)
highest education		0.009		-0.029		-0.139		-0.102
		(0.114)		(0.121)		(0.112)		(0.109)
leader in community		0.566+		0.183		0.499		0.470
		(0.319)		(0.329)		(0.309)		(0.303)
(# of children in hh+1)log		0.185		-0.247		-0.144		-0.031
		(0.285)		(0.303)		(0.286)		(0.279)
income index		-0.126		-0.141		-0.096		-0.120
		(0.117)		(0.121)		(0.111)		(0.109)
trust in com.		-0.523*		-0.510+		-0.269		-0.315
		(0.257)		(0.272)		(0.260)		(0.251)
previous activity for cc protection		0.210		-0.009		0.291		0.359
		(0.268)		(0.274)		(0.258)		(0.256)
cut1 cons	-2.773***	-2.644**	-4.872***	-5.818***	-5.126***	-6.182***	-4.616***	-5.106***
	(0.335)	(0.939)	(0.727)	(1.379)	(1.009)	(1.326)	(0.722)	(1.130)
cut2 cons	-1.273***	-1.135	-3.945***	-4.419***	-2.354***	-3.464***	-2.548***	-3.176***
	(0.216)	(0.904)	(0.478)	(1.072)	(0.293)	(0.909)	(0.298)	(0.924)
cut3 cons	1.572***	1.762+	-2.616***	-3.043**	0.339+	-0.859	-0.409*	-0.975
	(0.227)	(0.912)	(0.291)	(0.985)	(0.195)	(0.879)	(0.192)	(0.893)
cut4 cons			-0.073	-0.435	1.961***	0.817	1.439***	0.903
			(0.201)	(0.956)	(0.228)	(0.880)	(0.212)	(0.893)
N	290	253	288	250	286	248	286	249

*Notes: Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 16: Additional Regression Models H5

	Additional Models: Hypothesis 5							
	Individual action		No influence		No money		No time	
	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
after game	0.083	0.000	0.033	-0.143	0.193	0.032	0.371	0.312
	(0.260)	(0.288)	(0.265)	(0.299)	(0.269)	(0.297)	(0.288)	(0.320)
after workshop	-0.329	-0.363	0.420	0.322	0.021	-0.063	0.730*	0.648*
	(0.254)	(0.285)	(0.260)	(0.294)	(0.257)	(0.289)	(0.285)	(0.322)
gender		-0.550*		0.421		0.134		0.270
		(0.254)		(0.258)		(0.258)		(0.282)
age		0.154		0.002		0.436*		0.320
		(0.178)		(0.186)		(0.179)		(0.196)
marital status		0.138		-0.236		-0.095		-0.333
		(0.275)		(0.284)		(0.284)		(0.310)
highest education		0.131		-0.078		0.151		-0.093
		(0.102)		(0.108)		(0.112)		(0.118)
leader in community		0.111		-0.261		0.367		0.122
		(0.286)		(0.295)		(0.289)		(0.316)
(# of children in hh+1)log		-0.309		0.188		0.023		0.209
		(0.271)		(0.273)		(0.269)		(0.298)
income index		0.061		-0.049		-0.267*		-0.025
		(0.108)		(0.107)		(0.109)		(0.117)
trust in com.		0.330		-0.288		0.514*		0.306
		(0.234)		(0.248)		(0.245)		(0.265)
previous activity for cc protection		-0.219		0.076		-0.482+		-0.249
		(0.243)		(0.247)		(0.246)		(0.271)
cut1 cons	-1.492***	-1.015	-2.173***	-2.615**	-0.711***	1.455+	0.295	1.184
	(0.212)	(0.842)	(0.252)	(0.928)	(0.202)	(0.871)	(0.207)	(0.939)
cut2 cons	-0.249	0.228	-0.231	-0.559	0.751***	2.987***	3.177***	4.106***
	(0.189)	(0.837)	(0.195)	(0.907)	(0.202)	(0.888)	(0.313)	(0.983)
cut3 cons	0.172	0.706	0.225	-0.106	1.229***	3.506***	3.383***	4.345***
	(0.189)	(0.842)	(0.197)	(0.905)	(0.209)	(0.895)	(0.333)	(0.991)
cut4 cons	1.428***	2.053*	1.979***	1.684+	2.783***	5.081***	4.445***	5.256***
	(0.212)	(0.859)	(0.235)	(0.912)	(0.290)	(0.927)	(0.489)	(1.048)
N	287	249	289	251	289	251	287	250

*Notes: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX C

QUESTIONNAIRES AND PROTOCOLS

1. General individual survey for game players

a1 Please, could you tell me your name?

a2. Please, could you give me your phone number?

a3. Respondent's gender

Male Female

a4. How old are you?

Please enter the age of the respondent

a5. Are you a leader in the community or member of any communities, organizations or other groups?

Yes No

a6. Which role do you play in the community?

Please enter text

a7. What is your marital status?

1= single 2= married

3= divorced 4= widowed

a8. What is your highest educational attainment?

1= Elementary school 2= high school

3= vocational training 4= college

5= Master's degree 5= None

a9. What is the highest grade you went to?

Please enter text

a10. How many people are living in your household during the last year for at least six months? Please consider only people other than yourself.

1= girls under age 16? 2= boys under age 16?

3= women between 16 and 65? 4= men between 16 and 65?

5= elderly women more than 65 years old? 6= elderly men more than 65 years old?

a11. Which of the following sources of income do you have?

1= irrigated farming 2= rain-fed farming

3= animal husbandry 4= farm wage labor

5= off-farm wage labor 6= business

7= salaried employment 8= remittances or pensions

9= other 10= none

a12. In the last 12 months, how often did you eat less than you felt you should because there wasn't enough money for food?

1= almost every day
2= almost every week
3= almost every month
4= some months but not every month
0= never

a13. Which of the following things in an operational state does your household own? I will now read a list of items to you. Please tell me after each whether and how many of the things your household owns.

1= Radio
2= Television
3= Washing Machine
4= Air-condition
5= Solar power
6= Generator
7= Car
8= Motor cycle/scooter
9= Tractor
10= Other agricultural materials

a14. For how many years have you been living in this village?

Please enter a number

a15. Think about the people that live in this village, whether permanently or temporarily. How many of them would you entrust with something important and personal?

1= no one
2= very few
3= more than half
4= almost everyone

a16. During the past year, have you done anything to protect you, your family, and/or your community from floods/droughts?

1= yes, myself
2= yes, my family/household
3= yes, my community
4= no
5= don't know

a17. Do you think the implications of climate change can best be addressed by individual people, families or the community?

1= individuals
2= family/household
3= community
4= civil society organizations
5= government
6= it depends
7= don't know

2. Individual outcome survey for game players

b1. What do you consider for people in your village to be the three most serious problems today?

1= none	2= poverty and hunger
3= unemployment	4= corruption
5= global warming/climate change	6= global economic downturn
7= crime and violence	8= health and diseases (diabetes, HIV/AIDS)
9= improper use of land	10= youth delinquency
11= child abuse	

b2. What do you consider will be the three most serious problems for the people living in your village in 20 years?

1= none	2= poverty and hunger
3= unemployment	4= corruption
5= global warming/climate change	6= global economic downturn
7= crime and violence	8= health and diseases (diabetes, HIV/AIDS)
9= improper use of land	10= youth delinquency
11= child abuse	

b3. In the coming 20 years, do you think the following events will more frequently happen in your village?

1= Floods will occur more often	2= Heat waves will become longer than they used to be
3= unseasonal rainfall will occur more frequently	4= droughts/water shortage will occur more often
5= storms will be more severe	6= forest fires will be more severe
7= soil erosion will be more severe	

b4. How likely do you think it is that you have to relocate permanently from your current location, due to more frequent floods or droughts?

1= very unlikely	2= rather unlikely
3= rather likely	4= very likely
99= don't know	

b5. How likely do you think it is that future generations have to relocate permanently from their current location, due to floods and/or droughts?

1= very unlikely	2= rather unlikely
3= rather likely	4= very likely
99= don't know	

b6. How serious is the threat of climate change to you personally?

1= not serious at all 2= rather not serious

3= neither serious, nor not serious 4= rather serious

5= very serious

b7. How serious is the threat of climate change to the next generation?

1= not serious at all 2= rather not serious

3= neither serious, nor not serious 4= rather serious

5= very serious

b8. I can imagine a good life somewhere else such as in an urban area?

1= strongly disagree 2= disagree

3= neutral 4= agree

5= strongly agree

b9. Do you have family or friends where you can move in case of prolonged droughts or floods?

Yes No

b10. When did you last talk with community members about anything related to climate change?

1= last week 2= last month

3= last 6 months 4= last year

5= never

b11. I would like to be better informed about potential adaptation options

1= strongly disagree 2= disagree

3= neutral 4= agree

5= strongly agree

b12. I would like to be better informed about potential impacts of climate change

1= strongly disagree 2= disagree

3= neutral 4= agree

5= strongly agree

b13. Are you aware of any organizations that are active in addressing climate change implications in the Zambezi region?

Yes No

b14. If the previous question was answered with yes, please name the organization!

Please enter a text

c1. Do you care only about how others around you think of you and your actions (A);

or do you care about how future generations will think of you and your actions (B)?

1= mostly A 3= neutral 5= mostly B

c2. Do you only consider and deal with immediate concerns (A);

or do you consider how things might be in the future, and try to influence those things with your day to day behavior (B)?

1= mostly A 3= neutral 5= mostly B

c3. Please tell me, how far you agree or disagree with the following statements:

1= You feel empathetic/affinity toward future generations.

2= You are able to imagine future generations.

3= You understand the impact your decisions can have on future generations.

c4. Please tell me, how far you agree or disagree with the following statements:

1= In the future, you want to contribute to protect your community against the implications of the Climate Change.

2= You know how you can contribute to protect your community against the implications of the Climate Change.

3= With dedication and hard work, you are able to contribute to protect your community against the implications of the Climate Change.

4= There are many opportunities for you to protect your community against the implications of the Climate Change.

5= You are confident that you have the necessary skills to protect your community against the implications of the Climate Change.

6= Your individual actions can make a difference to the environment.

7= You are only one person, you can't make a difference to the environment.

8= Your economic situation does not allow you to protect the environment.

9= You don't have time to protect the environment.

c5. If you think about the life of the future generations, your grandchildren and their children: Where will they live?

Please enter a text

c6. If you think about the life of the future generations, your grandchildren and their children: Will they be farmers for their main occupation?

Please enter a text

Ladder of life

Please look now at the following ladder representing your economic situation in life. It has steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible economic situation in which one has more money than one can spend. This is a situation in which one has a stable and high income. The bottom represents the worst possible economic situation. At this point a person has no stable income and is not able to afford enough food every day. The middle position (step 5) corresponds to a person having a regular middle income allowing them to eat enough every day.

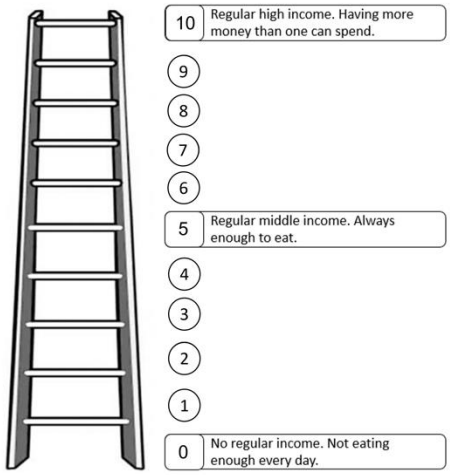
d1. Where are you currently?

d2. Where were your parents?

d3. Where do you expect to be in 10 years?

d4. Where do you expect your children to be ?

d5. Where do you expect future generations in this area will be on this ladder?



3. Protocol of the Intergenerational Community-based Climate Change Adaptation Game

How to use this document?

This document provides guidance on how to facilitate the Intergenerational Community-based Climate Change Adaptation Game (IGAG). Please note that text written in *red color and cursive* are statements which we propose to given directly to the players. Black color texts are instructions for the facilitators only.

Background on the game (for facilitators)

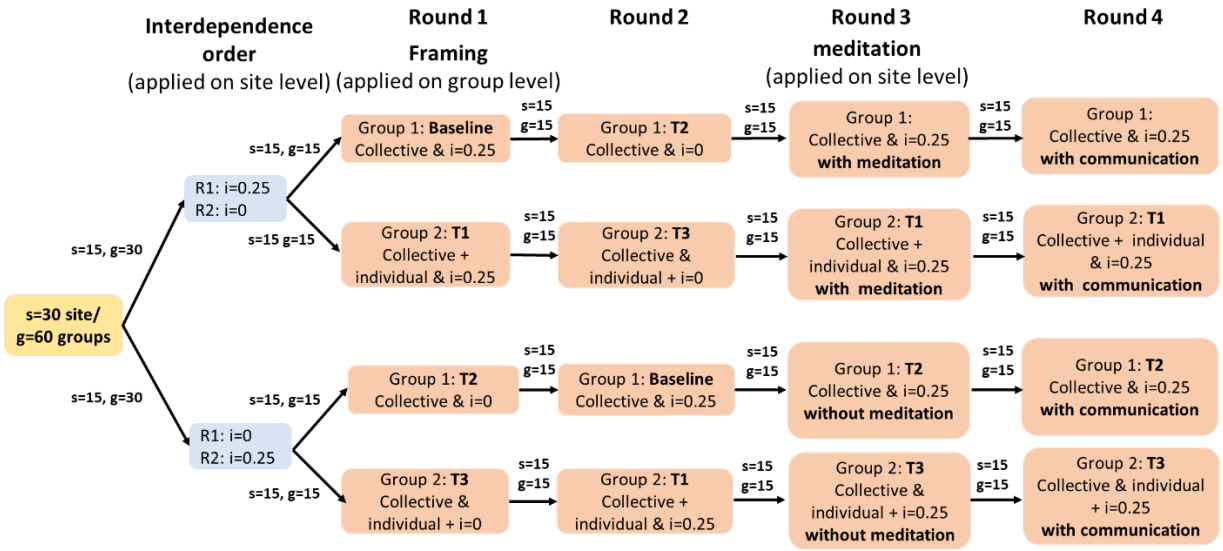
The Intergenerational Community-based Climate Change Adaptation Game (IGAG) was developed in the frame of the BMBF funded project NISANSA, Subproject 4. NISANSA focuses on social implications of climate change and related sustainability innovations in the global south. The project is funded by the German Ministry of Education and Research and runs from July 2021 to June 2024. NISANSA conducts regional and social science studies in southern Africa and northern South America. Our group as part of NISANSA examines the situation where a short-term focus in human behavior results in a neglect of future generations and their needs. There are path dependency of behavior leading to incremental modifications but not radically new solutions as it is essential for climate change adaption. The subproject develops approaches to strengthen a more long-term perspective enabling reflections on underlying values and assumptions. Eventually this may open the mind for new/alternative solutions.

The game will be used as an experimental approach to assess how path-dependencies affect human decisions. Thus, the IGAG shall show whether path dependencies of habitual in-situ adaption responses and outcomes for future generations can be reduced through either framing by making alternative solutions more salient or through cost-benefits, i.e. making alternative solutions more cost-effective to the status-quo of collective in-situ adaption. Furthermore, it shall be investigated whether trait and activated mindfulness can increase altruistic decisions and preferences for collective adaption even when it is not saving costs. In addition, IGAG shall create experiential learning spaces where participants can experiment in a low-risk space, learn how fellow community members behave and what consequences their action can have in the long term and on others. This kind of playful experience can accelerate a real-life learning process. The subproject will assess to which degree such learning has taken place.

Origin of the game

Our experimental study builds on a combination of the intergenerational goods game (IGG) developed by Hauser et al. (2014) and the dilemma of self-reliance studied in Gross & Böhm, (2020) and Gross & Dreu (2019). We build on the laboratory version of the intergenerational goods game (IGG) by Lohse & Waichman (2020) where the benefits of cooperation by current generations only occur to later generations. We make three major changes to this design. First, we reduce the number of generations from four to two. Secondly, when the threshold is not reached by the current generation, the subsequent generation still continues playing but receives an reduced endowment. Thirdly, we integrate a third decision option on top of free-riding that allows the group to either solve the shared problem collectively or individually as in Gross & Dreu (2019) – allowing people to avoid the free rider problem of the collective solution. Additionally, we implement the experiment with Namibian farmers who are predicted to be severely affected by more frequent droughts and floods and share a strong social cohesion which potentially favors collective adaptation solutions.

Game schedule – Figure 1



Materials required

The following materials are required to play the game:

- 20 Reusable Name tags
- 20 decision sheets
- 30 envelops in the size of the decision cards
- 30 Erasable markers
- 2 Cleaning cloths
- String to set up the posters
- Adhesive tape (two and one sided) to set up the posters
- Speaker and device to play pre-recorded guided meditation

Venue

We will need two venues per site as we will play with two groups simultaneously. We recommend to use quiet shady places with little disturbance giving space to at least 12 people. The venue needs to be large enough that 9 people can sit in a circle with a distance of at least 1 meter. Public meeting places or schools have been good choices in the past.

Choosing workshop participants

The target group of the IGAG influential community members. Local leaders will be asked to invite 20 people who play some kind of leadership role. At least eight of the participants should be women.

Prepare venue

At both venues, arrange sitting opportunities such as chairs or mats. Set up the facilitators desk with the computer to register the participants and later enter the player decisions. Set up banners with help of string and adhesive tape. Make sure that the banners are displayed in places that are easy for participants to see.

Registration of Participants

Please enter the name of the participants in the provided Excel-Sheet. When the participants arrive, they are randomly divided into two groups. This is always done alternately, i.e. the first participant belongs to group 1, the second to group 2, the third again to group 1 and so on. Write the player name and group number on the name tags and distribute the tags among the participants.

Conduct the introductory interview (KoboCollect: survey_general individual) directly during the registration when they arrive at the venue.

Oral consent

It is mandatory to provide adequate information about the project and to receive consent from the participants before starting the registration or the collection of data. Please provide the information of the consent sheet to the potential participants and ask them to sign the consent form. Please only include people in the workshop who provided consent. In addition, give them the background information about the project NISANSA provided on the Oral Consent Form.

Sometimes, as a result of an emergency, a player needs to leave the game. In such situation, a facilitator can substitute the player at any time. It is important that the change in player is clearly recorded.

General introduction

Please give the following explanation to all players at one of the venues:

General Framing:

People around the world face unprecedented changes in terms of economic development but also as the result of climate change. In recent years, the Zambezi region has become more and more threatened by the effects of climate change. Droughts and floods became more frequent and their frequency is predicted to further increase. Such natural disasters lead to severe damages of infrastructure, nature and the people's livelihood. Reacting to the implications of such changes requires actions at multiple scales, including on either the community level or the individual. The actions of the present generation thereby influence the welfare of future generations which have no opportunities to respond to present generation's actions. At the same time, actions of the present generation in the interest of future generations are costly at if it simply in terms of foregone enjoyment of today's comfort. We want to play a game with you which illustrates this situation and allows us to jointly explore it.

We thank you for participating in our workshop. For your participation, you will earn N$ 50 as a participation fee. You can earn more money. These additional earnings depend on your decisions and also on the decisions of the other participants in your session.

In the following, we will explain the task of the current game. In total we will play the game four times. Please listen to the instructions carefully. Please do not talk with other participants. Should you have any question, please raise your hand and the facilitators will answer your question.

Split the groups

Ask the people belonging to the two groups to go to the respective venue of their group. Without participants observing, please use a coin in secret to determine which of the groups will play the game with collective framing only and which one with the collective + individual framing. Below will be given instructions for each of the groups.

A total of 20 of you take part in the game session. The 20 of you who play the game will be randomly divided into two groups of 10 in each group. Please go to the area where your group will play.

2x2 Treatments

The game will be played with different thresholds for the individual investment solution. At some sites both groups first play with 20 N$ and at some sites first with 25 N$. We decide randomly on the site level which threshold is first used by a group.

Further, we will always let one group per site play with a framing and short group discussion before the first round which emphasizes taking collective action now in the interest of future generations while the other group only discusses the need of acting now.

Please pay attention to explaining the right version of the game to the right group.

The basic structure of the game

For all groups:

In this game, you will each take one decision. For this decision, each participant receives a hypothetical endowment. Each of you can decide simultaneously how much of the endowment to keep and how much of it to deposit to the development of your community or to give to your immediate future family members. The money that you do not want to invest into the future will be kept in your private account and paid to you at the end of the game together with the participation fee.

Let us start explaining the game more in detail. Each member of Generation 1 receives an endowment of 50 N$. Each member of Generation 1 decides simultaneously how much of the 50 N$ to keep and how much of it to invest either for all your community members or to actions which protect and support just your future family members. The amount you keep will be paid out to you in real money after the game. We will pay you the whole amount of all game rounds before the lunch break.

Let us start with the community actions. Any amount that you want to invest into the joint community action will be deposited in the group account of Generation 1. The amount deposited in the account of Generation 1 will be added up. If the total amount paid into the account of Generation 1 is 100 N$ or more, each player of Generation 2 will receive the same endowment amount of 50 N$ as you in the first Generation received. A fair solution would be if each member of Generation 1 pays 20 N$. If the members of Generation 1 do not pay at least 100 N$ in the group account of Generation 1, the next generation receives only half of the endowment which is 25 N$.

Future collective framing ONLY!:

This part of the game shall feature a common situation in many communities in the Zambezi region. We were told that in the past, many communities faced challenges such as droughts that people coped with by working together.

(For 5 minutes, let us take turns to share short stories about how the generations of our grandparents and parents used to live in the past as compared to how our generation lives now.)

Working together has often been more effective than individual efforts to deal e.g. with a drought, for example by pooling resources in case some people in your community lost their entire harvest. Sharing knowledge and expertise about new crops, varieties, or farming methods can help to protect resources, livelihoods and cultural traditions for future generations.

(This was all possible because our communities in the past understood the importance of Collective Action in order to obtain their shared goals.).

Together, you have the power to create a legacy of resilience, sustainable innovation, and collective change that will inspire and benefit generations to come. What are collective farming and natural resource management practices that could help conserve resources for future generations? What are specific skills, traditions, or knowledge you want the next generation living in this community to know? Tell me how important it is for you to work together with other members of your community!

(Participants are more compelled to work together when they feel a sense of belonging through sharing stories about the way their communities used to live in the past) (Either than that, I still used the explanations already given in the protocol as advised)

Encourage participants to share values and emotions related to working together as a community for sustaining livelihoods for future generations. What do they want to leave behind for future generations in this community? Allow them to respond for 3 to 5 minutes. You may remind them, that the focus is on working together as a community in the interest of future generations.

Please give one of the following explanations to the players depending on with which group you play:

Individual threshold = 20, i = 0

And each player also has the option to just invest into his or her immediate future family members. For this she or he needs to pay 20 N$ into the individual account. If you pay 20 N$ into the individual account, one player of Generation 2, who we assume to be your decedent, will get in any case the full endowment of 50 N$, independent on how much the others pay into the group account. Be aware, if four players of Generation 1 pay 20 N$ each into the group account but one player of Generation 1 pays 20 N$ into the individual account, the group will not reach the group threshold. If the players of Generation 1 did not collectively pay the threshold of 100 N$ in the group account but you paid the 20 N$ into the individual account, one player of Generation 2 receives the endowment of 50 N$ but all other players of Generation 2 receive only 25 N$.

Let us keep in mind, Generation 2 cannot influence Generation 1 and can also not reward or sanction them. We will play the game anonymously which means that you will not know who was in Generation 1 and who was in Generation 2.

Generation 1 can make their decisions using the decision card below. We will give each of you a decision card. If you see a (1) in the upper right corner, this means that you are member of Generation 1. If you see a (2) in the upper right corner, this means that you are member of Generation 2.

Show and explain the Decision Card of Generation 1 in case of i=0

The two pictures on the decision card symbolize the future generation. If you are a member of Generation 1, you can either tick on the right-hand side of the card whether you want to pay 20 N$ into the individual account. Or you can tick on the left-hand side to pay nothing, 10N$, 20N$, 30N$, 40N$, or 50N$ into the group account.

If you are a member of Generation 2, we give you a very similar card even if you cannot take a decision. You can express what you think the players of Generation 1 will decide. You can either tick on the right-hand side of the card whether you think that the players of Generation 1 will pay 20 N$ into the individual account. Or you can tick on the left-hand side whether you think that the players of Generation 1 will pay nothing, 10N$, 20N$, 30N$, 40N$, or 50N$ into the group account.

Show and explain the Belief expression card of Generation 2 in case of i=0.

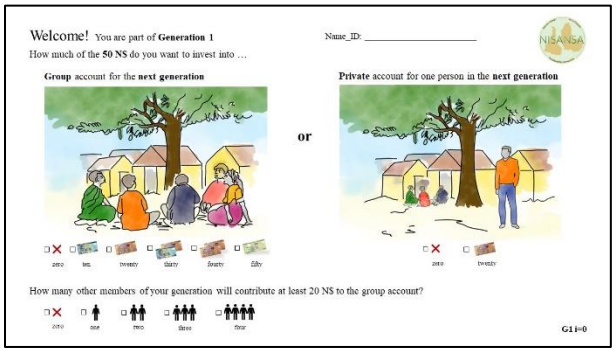


Figure 2: Decision Card of G1 in case of i=0

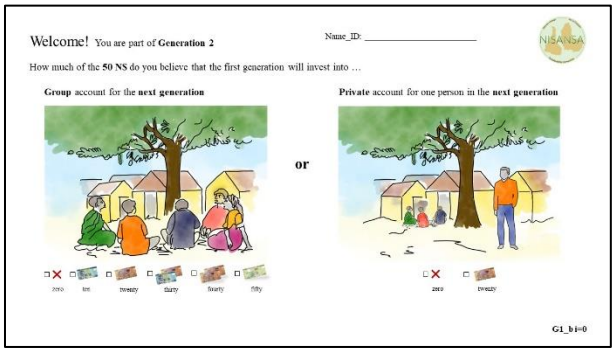


Figure 3: Belief expression card of G2 in case of i=0.

<u>Individual threshold = 25, i = 0.25</u>

And each player also has the option to just invest into his or her immediate future family members. For this she or he needs to pay 25 N$ into the individual account. If you pay 25 N$ into the individual account, one player of Generation 2, who we assume to be your decedent, will get in any case the full endowment of 50 N$, independent on how much the others pay into the group account. Be aware, if four players of Generation 1 pay 20 N$ into the group account but one player of Generation 1 pays 25 N$ into the individual account, the group will not reach the group threshold. If the players of Generation 1 did not collectively pay the threshold of 100 N$ in the group account but you paid the 25 N$ into the individual account, one player of Generation 2 receives the endowment of 50 N$ but all other players of Generation 2 receive only 25 N$.

Let us keep in mind, Generation 2 cannot influence Generation 1 and can also not reward or sanction them. We will play the game anonymously which means that you will not know who was in Generation 1 and who was in Generation 2.

Generation 1 can make their decisions using the decision card below. We will give each of you a decision card. If you see a (1) in the upper right corner, this means that you are member of Generation 1. If you see a (2) in the upper right corner, this means that you are member of Generation 2.

Show and explain the Decision Card of Generation 1 in case of i=0.25:

The two pictures on the decision card symbolize the future generation. If you are a member of Generation 1, you can either tick on the right-hand side of the card whether you want to pay 25 N$ into the individual account. Or you can tick on the left-hand side to pay nothing, 10N$, 20N$, 30N$, 40N$, or 50N$ into the group account.

If you are a member of Generation 2, we give you a very similar card even if you cannot take a decision. You can express what you think the players of Generation 1 will decide. You can either tick on the right-hand side of the card whether you think that the players of Generation 1 will pay 25 N$ into the individual account. Or you can tick on the left-hand side whether you think that the players of Generation 1 will pay nothing, 10N$, 20N$, 30N$, 40N$, or 50N$ into the group account.

Show and explain the belief expression card of Generation 2 in case of i=0.25:

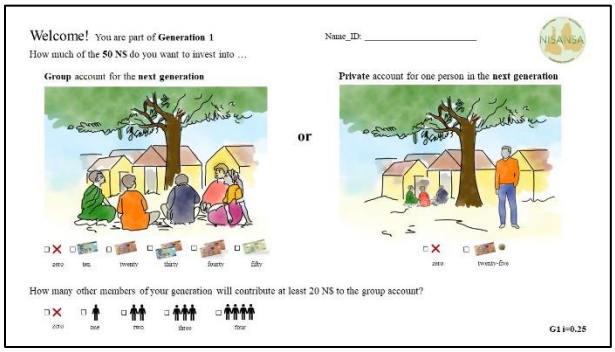


Figure 4: Decision Card of Generation 1 i=0.25

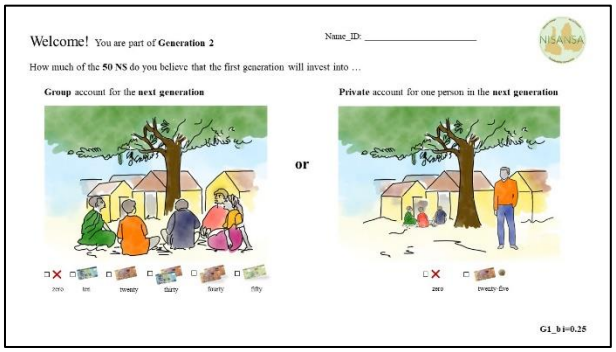


Figure 5: Belief expression cards of Generation 1 i=0.25

Now let us continue with Generation 2. Depending on the choices of the players of Generation 1, each player of Generation 2 receives an endowment of 50 N$ or 25 N$. The members of the second generation can now decide how much of their endowment they want to keep or want to donate to a kindergarten. For each 10 N$ invested by players, the project will add another 1 N$ for the kindergarten. The donation to the kindergarten will be paid out to a representative of the kindergarten or primary school or the parenthood of this community for any use in the interest of the children. There is a second alternative. In the afternoon, you will develop some ideas which may be a contribution to moving into a prosperous future for your community. Formulating this idea may support you and your community in initiating first strategic actions. You may need some money in the process of this idea development. The players of the second generation may also chose to donate to a fund which you can use for advancing your development idea. Again, we will add 1 N$ to each 10 N$ the second generation invests in this fund.

If you are a member of Generation 2, we will give you again a decision card to make this choice. You can tick, how much you would like to pay to the kindergarten or primary school. Any amount you keep will be paid out to you in real money after the game. We will pay you the whole amount of all game rounds before the lunch break.

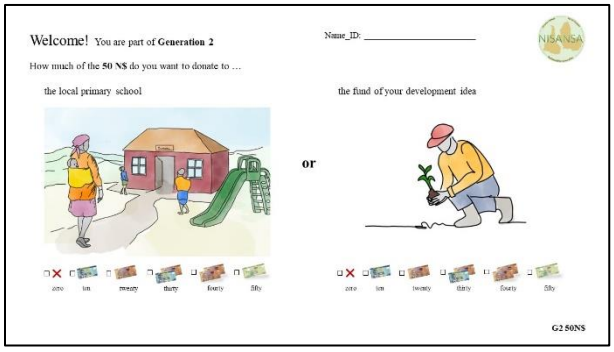


Figure 6: Decision cards of G2 in case of endow. = 50

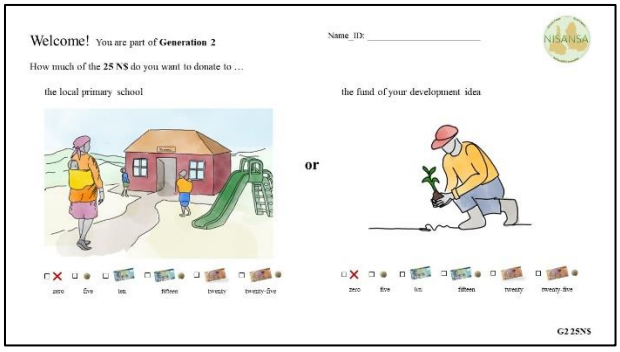


Figure 7: Decision cards of G2 in case of endow. = 25

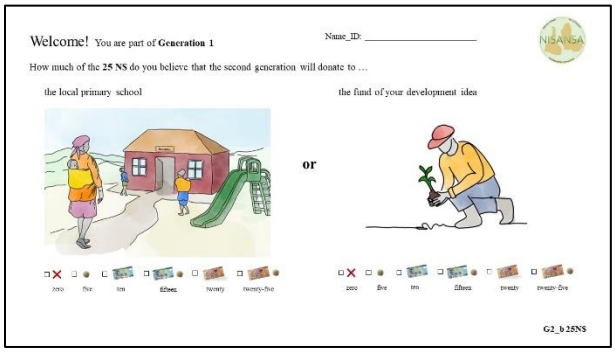


Figure 8: Belief card of G1 in case of endow. =50

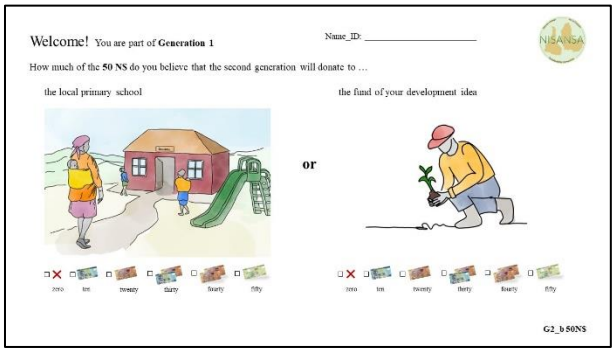


Figure 9: Belief card of G1 in case of endow.= 25

If you are a member of Generation 1, we give you a very similar card even if you cannot take a decision. You can express what you think the players of Generation 2 will decide. You can tick, how much you think the players of Generation 2 will pay to the kindergarten or primary school.

Examples

Give the participants a few examples to help them understand the game. Rather ask the questions to people who seem to be a bit slower in understanding. If anybody cannot answer, ask another participant to explain it to that player. If required, please explain the logic again.

Question 1: Imagine that all players of Generation 1 invested in total 110 N$ into the group fund. How much endowment will the players of Generation 2 get?

Question 2: Imagine that all players together had only contributed 50 N$ to the group fund? Assume that nobody invested in the private solution. Which endowment would the players of Generation 2 get?

Question 3: Imagine that all players together had only contributed 50 N$ to the group fund? Two of the players of Generation 1 invested in the private solution. Which endowment would the players of Generation 2 get?

Question 4: When the games are finished, the corresponding money will be paid to you. One of you will receive N$60, another will receive N$120. Why do you all get different amounts of money at the end?

If there are questions, please answer them. Once all questions are answered and you have the impression that the game is well understood, please continue.

Playing the game R1

As we hand out the decision cards, please make sure that other players do not see which decision you take. Please do not talk with each other.

Now let us start playing.

Hand out the Decision Cards and Belief-Expression Cards for the decision of generation 1. Make sure that you hand out the decision cards to the players of Generation 1 and the Belief-Expression Cards to the players of Generation 2. Pay attention that you use the right cards where the individual solution requires a payment of 20 N$ or 25 N$. The Excel-Data-Entry table will tell you which player will tell you who is in which generation.

The card you receive will tell you whether you are in Generation 1 or Generation 2. Players of Generation 1, please decide whether you want to pay any amount to the group found or to the individual solution. Players of Generation 2, please tick what you think the players of Generation 1 will decide.

If any participant is not able to read or write or has any questions, please go to the participant and help her/him. If required you have to explain again, how the decision sheet and belief expression sheet works.

Collect the sheets and enter all decisions in the Excel-Data-Entry table once any player finished filling the card. Count how much the generation 1 has invested into the group account. If it is in total more than 100N$, each player of the second generation gets an endowment of 50 N$. If it is less, the players of the second generation are only getting an endowment of 25 N$. If one or more players of the first generation have chosen the individual solution and have reached the threshold of 20 N$ (or 25 N$), one player of the second generation gets an endowment of 50 N$. The Excel-Data-Entry table will tell you which player will benefit from the individual solution.

Announce whether the collective threshold was reached. Hand out the Decision Cards and Belief-Expression Cards for the decision of Generation 2. Make sure that you hand out the decision cards to the players of Generation 1 and the Belief-Expression Cards to the players of Generation 2. The Excel-Data-Entry table will tell you which player will tell you who is in which generation.

Now, Players of Generation 2, please decide whether you want to pay any amount to the Kindergarten or to the fund for your development idea. Players of Generation 1, please tick what you think the players of Generation 2 will decide.

If any participant is not able to read or write or has any questions, please go to the participant and help her/him. If required you have to explain again, how the decision sheet and belief expression sheet works.

Collect the sheets and enter all decisions in the Excel-Data-Entry table once any player finished filling the card.

Please give one of the following explanations to the players depending on with which group you play:

Individual threshold in round 1 was 20, i = 0; In Round 2, individual threshold = 25, i = 0.25

This is the end of Round 1. We will now play the game a second time. Everything will be the same except that the amount you need to pay for the individual solution is not 20 but 25 N$. In this round, reaching the joint threshold of 100 N$ will still be possible if every player of Generation 1 pays 20 N$ into the group fund of Generation 1. But if a player wants to use the individual solutions from which only her or his future family member will benefit, she or he needs to pay 25 N$.

Individual threshold in round 1 was 25, i = 0.25; In Round 2, individual threshold = 20, i = 0

This is the end of Round 1. We will now play the game a second time. Everything will be the same except that the amount you need to pay for the individual solution is not 25 but only 20 N$. In this round, reaching the joint threshold of 100 N$ will still be possible if every player of Generation 1 pays 20 N$ into the group fund of Generation 1. But if a player wants to use the individual solutions from which only her or his future family member will benefit, she or he only needs to pay 20 N$.

Repeat the process as described in the Playing the game Section. Only make sure that you hand out the right Decision Cards and Belief-Expression Cards for the decision of generation 1 depending on with which group you play.

Meditation treatment

Now we want to test whether a brief guided meditation which we hope to influence the interior state of participants affects the decisions in the IGAG. For this reason, we decide randomly on the site level which sites will do the guided meditation and which ones will not.

No guided meditation

Just play another round of the game but always with the individual threshold = 25, i = 0.25.

With guided meditation

Prepare a space which is as little disturbed as possible. Prepare a circle of seating opportunities for all participants. Place the speaker from which the meditation can be played in the middle of the circle. Wait until both groups are finished with the first two rounds of the game. Then ask them to sit in the circle. If required, let the participants carry their chairs from the game playing area to the meditation area. Once everybody is seated, please tell them with a calm and relaxed voice:

Around the world, people note that we are almost permanently wandering with our minds into the past or the future. And people have observed that being present in this immediate moment changes the way how we relate to the world and the people around us. We invite you to a little exercise which shall help you to be more present in this moment. We will play you a recording with some simple instructions. Please just follow the instructions. You can sit or you may also stand up but most importantly, please do not talk or communicate in any other way with the other people of our group. We kindly ask you to silently listen to the recording and follow the instructions given.

Once the group calmed down, start playing the recording. You are invited to also participate in the meditation.

Once the recording is over, ask the participants:

Please walk silently back to the place where you have played the game. We will play another two rounds of the game. But we would like to play the game under the impression of the exercise you have just experienced.

Play another round of the game but always with the individual threshold = 25, i = 0.25.

Playing with communication

In the last round of the game, we allow the players to talk with each other. Please let them sit in a circle facing each other. In Round 4, do not hand out the Believe Cards. Tell them:

Now we played the game for three rounds and you were not allowed to talk. In this last round, you may discuss with the other players. As you play this round, you may propose which decision the other players should take. In this process it is likely and allowed that you find out who is in which generation. We will give you the same decision cards and follow the same process, only you are now permitted to talk. Also, we will not be handing out Believe Cards to you. So if you belong to generation 2, you can discuss with the generation 1 players what they should decide and vice versa. Play another round of the game but always with the individual threshold = 25, i = 0.25.

End of the game

We also want to see whether the game influences the visions which we develop in the afternoon workshop. For this reason, we conduct the afternoon workshop in some villages with the game participants plus other community members and in some villages only with people who did not play the game. We decide randomly at which sites will do the workshop also with game players or only with other community members.

This was the last round of our game! We thank you very much for playing with us. We will now have a lunch break. We brought some food for you/asked somebody to prepare some food for you. Please enjoy the lunch!

As we take the break, we will ask one after another of you to come to our desk to receive your payment. We will also ask a few of you to answer a few questions.

After the break, we will conduct a workshop on the future of your village. You may have done such workshops before and we want to invite you to think about the future of your community under the impression of the game we have just played. We will first discuss your experience with the game and then ask you to think about how you would like your village to look like in future. We would be very happy if you will join us for this workshop. Other community members will also be welcome to join.

4. Protocol of the Future Thinking Workshop

How to use this document?

This document provides guidance on how to facilitate the Future-Thinking Workshop of NISANSA TP4. Please note that text written in red colour and italics are statements which we propose to given directly to the players. Black colour texts are instructions for the facilitators only.

Materials required

- 10 thick pens,
- moderation cards,
- white board,
- white paper,
- 3 print outs of prototyping instructions
- tablet,
- USB stick (to save scenario presentation, project proposal, instructions for prototyping, and for saving their videos)

Background on the workshop (for facilitators)

The Future Thinking Workshop was developed in the frame of the BMBF funded project NISANSA, Subproject 4. NISANSA focuses on social implications of climate change and related sustainability innovations in the global south. The project is funded by the German Ministry of Education and Research and runs from July 2021 to June 2024. NISANSA conducts regional and social science studies in southern Africa and northern South America. Our group as part of NISANSA examines the situation where a short-term focus in human behavior results in a neglect of future generations and their needs. There are path dependency of behavior leading to incremental modifications but not radically new solutions. The subproject develops approaches to strengthen a more long-term perspective enabling reflections on underlying values and assumptions. Eventually this may open the mind for new/alternative solutions.

The main purpose of the Future-Thinking Workshop (FTW) is to initiate community-driven climate change adaptation action. The IGAG in combination with the FTW shall influence different aspects of mental models and initiate community-based planning activities as a behavioral response. This includes the intention to document changes in mental models and behavior.

The workshop will take place in the afternoon of the workshop day and is open for all participants who wants to join. It is expected that the workshop will last around 3 hours.

The workshop will include:

- Deliberation/Debriefing: Reflect on the game experience and intergenerational justice in the context of climate change adaptation [duration: 45 min]
- Visioning: Formulate a vision for the future of the community in the face of change scenarios [60 min]
- Input: get information on climate change and economic development scenarios [20 min]
- Adoption options ranking [20 min]
- Homework prototyping [20 min]

It is important that the participants feel free to express their views. The facilitation provides a structure for this discussion but within this structure, the participants must feel free to share their perspective and ideas and to develop own solutions. It is important that the participants will have the feeling that they own the workshop outcomes. Therefore, please avoid interrupting discussions or probing. Only if they strongly deviate from the workshop topic, please remind them of the tasks they are asked to do next.

Please open the workshop:

Dear community! Thank you for being back and joining us for this workshop on the future of the community. We invite you follow with us through some steps of discussions which may stimulate discussions on how the community can prepare itself for the future and how it can best take care of the future generation.

Oral consent

Please ensure that all participants of the workshop have been given the introduction as described in the Informed Oral Consent Sheet. All participants should have signed the form. Please ask:

Before we start, has anybody of you not been present in the morning when we explained the details of the project and where we asked you for your consent to participate in the workshop?

If there are people who have not yet been informed and given their consent, please take them to the side and follow the procedure as described in the Informed Oral Consent Sheet.

Documentation

Please ensure that notes are taken on all discussions of the participants. One facilitator should always focus entirely on note taking. You can take turns. If possible, record the discussion using tablets or other devices.

Deliberation/Debriefing [45 min]

To start this workshop, we want to reflect on the game experience and linking it to intergenerational justice in the context of climate change adaptation. This debriefing shall stimulate discussion amongst the participants. The main role of the facilitator is to support the interaction between the participants. The facilitation should interfere as little as possible in the discussion – as long as it remains focused on the topic of the game experience, intergenerational justice and climate change implications. This requires to be patient and let participants draw their own conclusions. Refrain from hinting or giving advice as this undermines the participants' inspiration.

The following questions are taken and for our use adapted from "Crookall, D. Debriefing: A practical guide. To appear in Angelini, L.M. & Rut Muñiz, R. (Eds.) (2022). 1 Simulation Applications in Education: Towards a Collaborative Approach to Teaching and Learning. Springer Nature". The chapter in the listed book by Crookall first discusses what debriefing is and when to use it. Furthermore, it discusses why and how one should use it. The appendix contains several practical examples of debriefing. The majority of the questions used here are taken from the debriefing materials used for Fishbank (Table 11) which are adapted to our context. As people respond to the questions, try to intervene as little as possible. The aim is to stimulate a discussion among the participants.

Description of game	1. Did anything happen during the game which was particular insightful for you? If yes, can you please describe?
Emotions	2. How did you feel while playing the game? (Once one participant answered:) Was it similar for all of you or did anybody have different emotions?
Outcomes	3. What was your main aim during the game? 4. Are you happy with the outcome of your generation?
Progress	5. Is there anything you feel you have learnt during the game? If yes, can you please share what it was?
Real world	6. Do you see a link between the game and anything that you experience in real life?
Future	7. Did you learn anything during the game which may affect your future actions?
Feedback	8. What advice would you offer to the game designers and/or the facilitators?
Comments/Other	9. Is there anything else you would like to share with the group or with the facilitators?

As people respond to the questions, try to intervene as little as possible. The aim is to stimulate a discussion among the participants.

Dear participants, we now want you to reflect on your experience with the game in the morning. Let us ask you a few questions to stimulate your discussion.

Did anything happen during the game which was particular insightful for you? If yes, can you please describe?

Give approximately 5 to 7 minutes for discussions on this question!

Ask the data entry operators for the average endowment of Generation 2 in both groups of the game.

Generation 1 always received an endowment of N$ 50. Generation 2 in your groups received an average endowment of N$?? and N$??. Are you happy with the outcome of the different generations?

Give approximately 5 to 7 minutes for discussions on this question!

Do you see a link between the game and anything that you experience in real life?

Give approximately 5 to 7 minutes for discussions on this question!

Did you learn anything during the game which may affect your future actions?

Give approximately 5 to 7 minutes for discussions on this question!

What advice would you offer to the game designers and/or the facilitators?

Give at maximum 5 minutes for sharing! If somebody has more to share, offer a bilateral discussion.

Is there anything else you would like to share with the group or with the facilitators?

Give at maximum 5 minutes for sharing! If somebody has more to share, offer a bilateral discussion.

Adoption options ranking [20min]

Now we want them to set priorities based on the EIF strategic focal areas.

Ensuring prosperity of your households and the community requires taking strategic actions. This entails mobilizing individual resources and resources of the community. To support future-oriented initiatives of Namibian citizens and communities, the Environmental Investment Fund (EIF) offers different support mechanisms. The EIF has the overall aim of supporting individuals, projects and communities that ensure the sustainable use of natural resources in Namibia.

EIF has different priority areas. Where do you see the strongest potential for you and your community to prepare for a future with a growing population and climate change?

EIF supports individuals and communities. We therefore also ask you:

In the area where you see the strongest development potential, do you think that rather individual and household level actions, or initiatives of the community can create meaningful changes.

Please ask the respondents to vote for the options by raising their hands. Use the tablet to record the total number of supporting votes. Do not forget to also count the total number of workshop participants.

Name:		Played game:
Strategic focal area	Type of activity	Tick the one you consider to be most relevant:
Natural Resource Management	Individual or household level activities	
	Community level activities	
Tourism development	Individual or household level activities	
	Community level activities	
Green Technologies and low carbon development	Individual or household level activities	
	Community level activities	
Research, training, and capacity-building	Individual or household level activities	
	Community level activities	

Visioning [60 min]

In this section, we ask the participants to formulate a vision for the future of the community in the face of change scenarios. This tool helps to bring the participants of the FTW, i.e members of the community, together to develop a shared vision of the future, as well as to generate a common goal, hope, encouragement, creative thinking and passion (Brouwer, Herman and Brouwers, Jan , (2017) The MSP Tool Guide: Sixty tools to facilitate multi -stakeholder partnerships. Companion to The MSP Guide. Wageningen: Wageningen University and Research, CDI). By using the approach by Szpunar and Szpunar (2016) of the so-called „Future as a forethought“, we want to start the process with a vision how a group wants the future generation's life to look like in the face of climate change and to draw attention more strongly to the resources and agency of the group. Therefore we are going to ask the participants the following question: *What do you want to see in place 5-10 years from now in your community in the face of climate change? What do you really want?*

Methodology: How to facilitate visioning group work (inspired and adapted from Brouwer and Brouwers (2017). MSP Tool Guide; Tool 41;

https://www.researchgate.net/publication/316072259_The_MSP_Tool_Guide)

Now we want you to formulate a vision for your community. How would you like it to look like in future? Imagine that we travel in time. We are in the year 2053 – 30 years from now. Imagine there will be a documentary team coming to your community because your community became famous for its development, how it adapted to climate change, and how it takes care of future generations. Let us first collect ideas in smaller groups!

Create randomly groups of 5 to 7 people. Please create separate male and female groups to capture the different perspectives of women and men with regards to community development. Mark on the facilitation cards whether a card was written by a female or a male group.

As you are discussing in groups, please note down elements of your community's future. The questions shall inspire you. You do not need to answer each of them. Please write the important elements of the prosperous future of your community on the cards which we give you!

Write the following questions on a white board in Lozi and read them:

- *What achievements have been made that you would like to share with the documentary team?*
- *How do outside organizations collaborate?*
- *What laws, rules, attitudes, or paradigms have changed?*
- *How did you prepare yourself for a life under climate change?*
- *How does the situation you describe affect different groups in the community today and tomorrow?*

Let the groups brainstorm for app. 15 minutes. Then each group shall present the most important elements of their vision.

One facilitator writes the elements on facilitation cards, places them on the ground and clusters them thematically.

Can one representative of each group present the most important aspects of the community's future! Please come forward.

Please ensure that you collect all cards with elements, write on the back side of all cards the village name and enter the list of elements into an excel table which also makes clear which elements where mentioned in this village.

Please ask, once all groups are done:

Now that you see the emerging picture, do you think any important aspect is missing?

Next ask the participants to give names to the thematic clusters:

How would you call the different clusters which emerged here? What is the common direction, and the key element of the ideas under this cluster?

Now ask them to enact the interview. Please record the interview using the tablet camera. One facilitator takes note of all aspects of interview. Use a second tablet and hold it closer to the speaking people to make an audio recording of the interview. Store the video and the audio recording on different devises and share it with the participants after the workshop on a USB stick.

Now imagine that the documentary team visits your village because they have heard that extraordinary developments take place here. Please enact the interview! You can record it in pieces using a cell phone or another camera. Two of you should play the documentary team and two to five are interviewed. The documentary team will ask questions like:

- *What is so special about your community?*
- *What has been achieved?*
- *How do outside organizations collaborate with the community?*
- *What attitudes or norms have changed?*
- *How do you prepare yourself for a life under climate change?*
- *How does the situation you describe affect different groups in the community today and tomorrow?*
- *Who had to do what to move towards the situation where the community is today?*

The interview partners should answer based on the elements of your community's future as has been worked out in the previous step. You can do this spontaneously or first prepare a script for who asks which question and who gives which answer.

Homework prototyping [20 min]

The next step is meant to be a home work for the communities. We propose them to develop a prototype an adapt the prototyping tool of Brouwer and Brouwers (2017) (MSP Tool Guide; Tool 43). A prototype makes it possible to generate insight into the pros and cons of your idea before a lot of time, energy and resources are invested. They offer an option to quickly experiment and get feedback on the essential elements of a proposed idea earlier in the process. Prototyping has three main elements:

- Build to think: creating a solution so that it can be communicated to others and making the idea better.
- Rough, rapid, right: Prototypes do not need to be perfect, it is about learning fast by creating a quick and cheap way of experimenting.
- Answering questions: It is essential to identify which question you want to answer with a prototyping tool.

Please explain to the participants:

As a next step, we encourage you to develop your ideas of one project which may be a contribution to moving into the direction of the future which you described in the interview before. Formulating this idea may support you or your community to initiating first strategic actions. We offer to share your project ideas with local regional stakeholders and they can be the basis for an EIF proposal.

For illustrating you project idea, we propose you to create a storyboard. Storyboards allows you to make a simple sketch that quickly visualizes your project idea. The sketches don't have to be very detailed or beautiful. Rather, it's about brainstorming and putting ideas into a format which can be shared and discussed. The process of creating a storyboard can additionally help think through the idea. You can think of this as a comic book. All you need are pens and paper.

As you design the storyboard of your prototype, please take another look at your answers to the following questions:

1. *What (local) changes are necessary for achieving the vision you described to the documentary team? (Outcomes)*
2. *What are the opportunities, potentials, benefits, and other effects of the future vision?*
3. *What structural, institutional, and regulatory changes would be necessary? (Obstacles)*
4. *Who would need to do what to move towards the vision you described to the documentary team?*

You have answered them in the interview step. Your storyboard should illustrate your key ideas about who needs to do what to move towards the vision you described to the documentary team. Please follow the following steps:

- *Determine which actions by who do you want to visualize!*
- *Please order these actions in time?*
- *Discuss how these actions can be illustrated in a series of drawings!*
- *Discuss how the vision you described to the documentary team can be illustrated in a drawing!*
- *Will it be plausible that the actions you describe lead to the vision? If not, are intermediary steps necessary to add?*
- *Find somebody in your community who feels confident to draw your illustrations and let her/him draw them each on a separate paper!*
- *Present the storyboard to the community and ask for feedback. If required, make changes.*

Find somebody who has a smartphone and take pictures of your storyboard.

Closure

This is the end of our workshop! We thank you very much for having us and being with us. Let us close with a prayer. Who can give us a prayer?

Making payments

Before you leave we will pay out the game participants. We will call you one after another to the front.

Ask the data operator which players needs to be interviewed after the workshop. First pay out those players and then do the Outcome interview with them.

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BIOGRAPHICAL SKETCH

Franziska Auch, born in Stuttgart, Germany, graduated from the Helene-Lange-Gymnasium in Markgröningen in 2017. After completing her bachelor's thesis on "The importance of the European Green Deal for the sustainable transformation of the regional innovation system in Stuttgart" at the University of Hohenheim in 2021, Franziska focused in particular on environmental and innovation economics. In the following two years, she deepened her expertise as part of a double master's degree in "International Political Economy" at the Philipps-University of Marburg and The University of Texas at Dallas with a focus on behavioral economics and sustainability. As a research assistant at the Institute for Sustainable Use of Natural Resources at the Philipps-University of Marburg, she conducted field research in Namibia for two months in 2023 as part of the NISANSA project. Since August 2023, Franziska has been continuing her master's program at The University of Texas at Dallas.