

# Interlinkages between leverage points for strengthening adaptive capacity to climate change

Linda Rosengren,  
Project Manager, Natural resources Institute Finland (Luke)  
PhD Candidate, Faculty of Agriculture and Forestry, University of Helsinki  
email: [linda.rosengren@luke.fi](mailto:linda.rosengren@luke.fi)

## Approved by

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**Supervisor:** Thomas Schinko  
**Program:** Population and Just Societies Program  
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## Abstract

Systemic leverage points are gaining ground within the socio-ecological systems and sustainability literature. Few studies, however, investigate the role of interlinkages between related leverage points in instigating, amplifying or hindering desired change. The objective of this study was to explore this knowledge gap by studying the interaction between four leverage points for strengthening adaptive capacity: access to finance, access to and use of information and knowledge, social learning and gender equality. The study used a multi-methods approach including semi-structured interviews, a participatory visual art method and a reflection session in a case study in Northern Region of Ghana.

The research found a rich web of interlinkages that we argue play a role beyond this case study in how desired change unravels. First, interlinkages can enable or hinder another leverage point. Second, interlinkages can instigate feedback loops. Third, interlinkages can affect the system in different levels of depth.

These three features of the interlinkages make them highly relevant for transformation and sustainability science that also hold relevance in policy and intervention planning.

**Keywords:** Leverage points; interlinkages; qualitative methods; Ghana; adaptive capacity

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## About the author

**Linda Rosengren** is a researcher at Natural Resources Institute Finland (Luke) and a PhD student at University of Helsinki. (Contact: [linda.rosengren@luke.fi](mailto:linda.rosengren@luke.fi) )

## Introduction

Systemic leverage points are increasingly recognized as an important lens to detect effective possibilities for initiating transformations toward sustainability. Leverage points provide guidance on where to most effectively intervene in a system, they have the ability to deal with complex systems, they provide the possibility of both causal and teleological decision-making, and the possibility to target deep, transformative change (Meadows, 1999, Fischer, Riechers, 2019). They also provide a pathway to understand how relational values, among other human-nature connections, can be embedded in environmental policy and how the economic growth pathway can be shifted to focus on human well-being (Riechers et al., 2021, West et al., 2020).

Increasing scholarly attention is being devoted to the interconnections between leverage points, for example as a way to support the achievement of multiple UN Sustainable Development Goals (Swain, Ranganathan, 2021). Abson et al. (2017) claim that leverage points are not independent and that the results from acting upon one leverage point can be unexpected and complex. Chan et al. (2020) argue that there are possible synergies depending on the context and implementation of the leverage points. Fischer and Riechers (2019) introduce the importance of creating a “chain of leverage”, meaning that multiple leverage points can interact and enable one another.

Additional studies have assessed the interlinkages between deep and shallow leverage points. Systemic leverage points can be divided into so-called deep and shallow leverage points. Shallow leverage points are easier to act upon but have less potential to bring out transformative change compared to deep leverage points. Deep leverage points on the other hand concern systemic, far reaching or transformative change that generally is hard to ignite (Abson et al., 2017). Creating a situation where shallow leverage points would ignite change that would create an enabling environment to tackle also deep leverage points seems particularly interesting. Pérez-Ramírez (2021) and Tourangeau and Sherren (2020) studied the different levels of leverage points including deep and shallow leverage points, Pérez-Ramírez (2021) related to participatory farming in Spain and Tourangeau and Sherren (2020) sustainable wool production on the Falkland Islands. Neither Pérez-Ramírez (2021) nor Tourangeau and Sherren (2020) study however explicitly the interlinkages emerging between the different levels of leverage points and how they could instigate transformational change.

Recent work demonstrates the importance of interlinkages among leverage points in the Global South. Manlosa et al (2019) found that shallow leverage points can also enable deeper change in societal structures and norms related to gender equality in Ethiopia. Jiren et al. (2021) explore the interplay between formal and informal institutions related to food security in Ethiopia. They show how different institutions interact to impact food security outcomes. Institutional interplay is thus an interlinked which occurs within (e.g., competing designs) or across levels of systemic depth (e.g., interventions of formal institutions running against the mission of informal institutions). Burgos-Ayala et al (2020) studied how shallow and deep leverage points related to indigenous and local knowledge in environmental management in Colombia.

In wider studies, scholars have examined interconnections between leverage points to understand pathways to nature connectedness (Richardson et al., 2020), as a means to reach food security and environmental objectives (Kuiper, Cui, 2021) and to better understand how relational values can be incorporated into nature conservation practices (Mattijssen et al., 2020).

These interlinkage studies seek to examine correlational or causal relationships between leverage points, mainly between deep and shallow leverage points. These studies do however not provide a deeper understanding of how the nestedness of the system contributes to creating or hampering

change. Little attention has so far been given to depicting how the interaction between leverage points poses an indirect impact on the system that might not have a clear causal relationship. Consequently, we know where the entry points for creating change exist and that associations exist but are unable to explain how those interlinkages form and how they either can hinder or amplify change and why they matter to local communities facing rapid environmental change. Indeed, recent commentaries indicate that understanding how leverage points work in connected or nested systems is a major research question facing sustainability science and practice (Leventon, Abson & Lang, 2021).

We build upon these important works exploring the interlinkages between multiple leverage points for strengthening adaptive capacity to climate change. Leverage points for strengthening adaptive capacity to climate change are points in the system that hold potential to improve adaptive capacity of people and communities. There is no one single universally agreed upon definition for adaptive capacity. IPCC provides, however, the following definition for adaptive capacity: 'the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences' (IPCC, 2014). Building adaptive capacity has been considered as a steady and linear progress. Rosengren et al. (2020) however explored the use of systemic leverage points to fast-track positive adaptive capacity trajectories. With this article we inspire to bring further insight in regard to how to further amplify desired change by being mindful of the interlinkages between leverage points and the indirect impact through which they affect the specific system under consideration.

## **Theoretical background**

### **Leverage points**

Systemic leverage points were first introduced by Donella Meadows in 1999 (1999). Nearly 20 years later the concept was brought back to a central stage of the sustainability and transformation community through the publication "Leverage point for sustainability transformation" by Abson et al (2017). Abson et al (2017) grouped the initial twelve leverage points into four groups according to system characteristics. The four groups or realms are: parameters, feedbacks, design and intent. Abson et al (2017) define the four realms as follows: parameters are the shallowest leverage points and relate to stocks and flows of the system as well as mechanistic characteristics. Feedbacks are intermediate shallow system characteristics that control the system dynamics and interaction between elements. To the intermediate deep leverage point realm called design belong the system characteristics that control social structures. Finally, the deepest realm is called intent and includes the values and norms and worldview that shapes the direction of the system. The basic idea is that in order to achieve transformative change emphasis has to be put not only on shallow but also on deep leverage points.

### **Leverage points for strengthening adaptive capacity**

Adaptive capacity is one of the key concepts of climate change adaptation. Adaptive capacity is generally context- and place-specific and not equally distributed (Adger et al., 2007, Armah et al., 2015, Siders, 2019). Adaptive capacity is the latent ability to be able to mobilize necessary resources when needed (Engle, 2011). Adaptive capacity is also influenced by the ability to act collectively, by the networks and knowledge there is at hand as well as by the willingness and agency to act (Engle, 2011, Adger, 2003, Brown, Westaway, 2011). Cinner et al (2018) define adaptive capacity to consist of five domains: assets, flexibility, social organization, learning and agency.

Rosengren et al (2020) propose two ways to approach adaptation planning: 1) using so-called generic or 2) place-specific leverage points for strengthening adaptive capacity. The generic leverage points for strengthening adaptive capacity are, as the name alludes to, broader and more general in nature and need to be combined with meaningful context-specific interventions. The generic leverage points can be used as a starting point for policy and intervention planning activities. The generic leverage points

include the following four areas: access to finance, access to and use of information and knowledge, social learning and gender equality and are according to Rosengren et al (2020) relevant entry points for strengthening adaptive capacity broadly in the Global South.

#### **Four generic leverage points for strengthening adaptive capacity**

The four generic leverage points are according to Rosengren et al (2020) of most use if considered as an ensemble. In this article we explore the interlinkages that explains why it makes more sense to address the four leverage points together. Access to finance in the context of leverage points for strengthening adaptive capacity means possibilities for people to be able to loan money or take credit. In a Global South context this can be through a savings group or microcredit provider. But without the relevant information and knowledge it can be hard to manage finances and find opportunities etc. The leverage point regarding information and knowledge also includes local, traditional and indigenous knowledge as important aspects of finding solutions to climate change adaptation. Social learning is according to Ensor and Harvey (2015) a way to facilitate knowledge sharing, joint learning, and co-creation of experiences between stakeholders around a shared purpose in ways that: 1) take learning and change beyond the individual to communities, networks or systems, and 2) enable new, shared ways of knowing that lead to changes in practice. The fourth generic leverage point – gender equality - addresses the gendered power imbalances that impact women’s ability to adapt to climate change (Adzawla et al., 2019).

#### **Place-specific leverage points for strengthening adaptive capacity**

The place-specific leverage points for strengthening adaptive capacity on the other hand take consideration to location and context. The place-specific leverage points included in this study are previously identified in the study by Rosengren et al (2020) and include: savings groups, microcredit schemes, agriculture extension services, Innovation Platforms, and agency. These form the topics covered in this study and area briefly described below.

Savings groups were among the most common ways to save and loan money in the case study area and provided a possibility for people with a low threshold to access finance. Also, microcredit schemes offered a possibility for people living in the case study area to access finance. Microcredits are provided by a range of operators in the case study area including NGOs and private institutions. Both savings groups and microcredit schemes fall under the generic leverage point “access to finance”.

Agriculture extension services was identified as one of the main sources of information in the case study area related to how to adapt farming to the challenges that the changing climate is posing. The extension services are part of the government administration under the Ministry of Agriculture. The extension agents circle the rural communities to raise awareness on good farming practices. Agriculture extension services is a place-specific leverage point falling under the generic leverage point “access to and use of information and knowledge”.

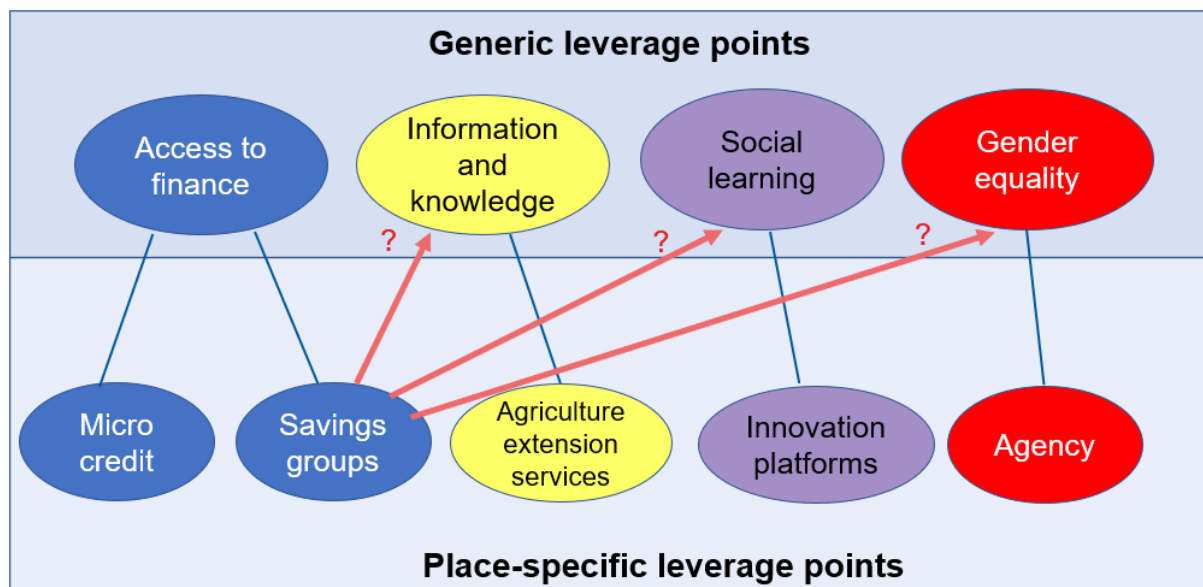
Self-organized social platforms that build trust, social cohesion and provide a platform for collective learning was previously identified as a place-specific leverage point for strengthening adaptive capacity in the case study area. Two such platforms were established in the case-study area and run for about a year prior to the data collection of this study. We call these two platforms Innovation Platforms. More related to the membership and function of the Innovation Platforms can be found in the sub-chapter samples. The place-specific Innovation Platforms fall under the generic leverage point “social learning”. Finally, the place-specific leverage point “agency” addresses the generic leverage “gender equality”.



### Interlinkages between leverage points for strengthening adaptive capacity

Each of these place-specific leverage points fall under one of the four generic leverage points as visualized in *Figure 1*. The identified interlinkages presented in the study are interlinkages between a place-specific leverage point and a generic leverage point other than the one that the place-specific leverage point falls under. For example, microcredit schemes that fall under the generic leverage point “access to finance” interlinks with all the three other generic leverage points: information and knowledge, social learning and gender equality.

The previous study that identified the place-specific leverage points for the case study included in this study also contained other places specific leverage points but only the ones with the most interlinkages were selected to be included in this study.



*Figure 1. The figure visualizes the two levels of leverage points for strengthening adaptive capacity: the generic leverage points that are relevant more broadly in the Global South and the place-specific leverage points that are relevant for the case study included in this research. The blue lines show which place-specific leverage points belong to which generic leverage point and vice versa. The orange line with the question mark stemming from “savings group” to the three generic leverage points show the potential interlinkages that are explored in this study.*

We consider interlinkages in this article as associations between the place-specific and the generic leverage points. The empirical data representing the interlinkages are distilled from discussions with study participants regarding the place-specific and generic leverage points. The interlinkages were derived during discussions with the project participants regarding the benefits, challenges, future desires and suggestions on how to achieve the desired future state. We included in this article associations that influence the generic leverage points in either a positive or negative way. We also found associations that were neutral in nature, but we have not included them in the study. The data also included many more aspects related to the place-specific leverage points that did not contain an association to any of the four generic leverage points. These aspects are not included in this article.

Based on this analysis we address the article’s objective to better understand the interaction between leverage points and how this interaction affects the desired change. This article answers the two following research questions:

- What are the interlinkages between the place-specific and the four generic leverage points for strengthen adaptive capacity to climate change?
- What is the nature of the interlinkages (enabler/barrier) and to which level is the system affected by the interlinkage (deep/shallow)?

## Material and methods

### Case study area

The case study area is situated in the Northern Region of Ghana. The area has a semi-arid climate and belongs to the savanna agroecological zone (Aniah, Kaunza-Nu-Dem & Ayembilla, 2019). Climate change is already impacting the area. A study tracking rainfall patterns between 1960 and 2007 found that rainfall patterns have changed (Boafo et al., 2016). Also, temperatures are rising (Abbam et al., 2018) and are predicted to continue to do so (Sylla et al., 2016). This poses a direct threat to predominantly rainfed subsistence farming (Wossen, Berger, 2015). Poverty is prevalent and people's ability to deal with shocks is limited (Wossen, Berger, 2015). Literacy rates in rural areas of the Northern Region are according to the Ghana Statistical Service (2019) 25% for men and only 15% for women. Diversification of livelihoods is low, which deepens the population's vulnerability (Dumenu, Obeng, 2016).

The study area is predominantly Muslim where polygamous marriages are common (Agadjanian, Ezeh, 2000). The social structure is patriarchal, placing women in a subordinate role to men. This is reflected in girls' lower access to education (Atta, 2015), sexual harassment of girls by teachers (Atta, 2015), forced and early marriage (Alhassan, 2013) marital violence (Tenkorang et al., 2013), and exclusion of women in decision-making regarding livelihood matters (Apusigah, 2009).

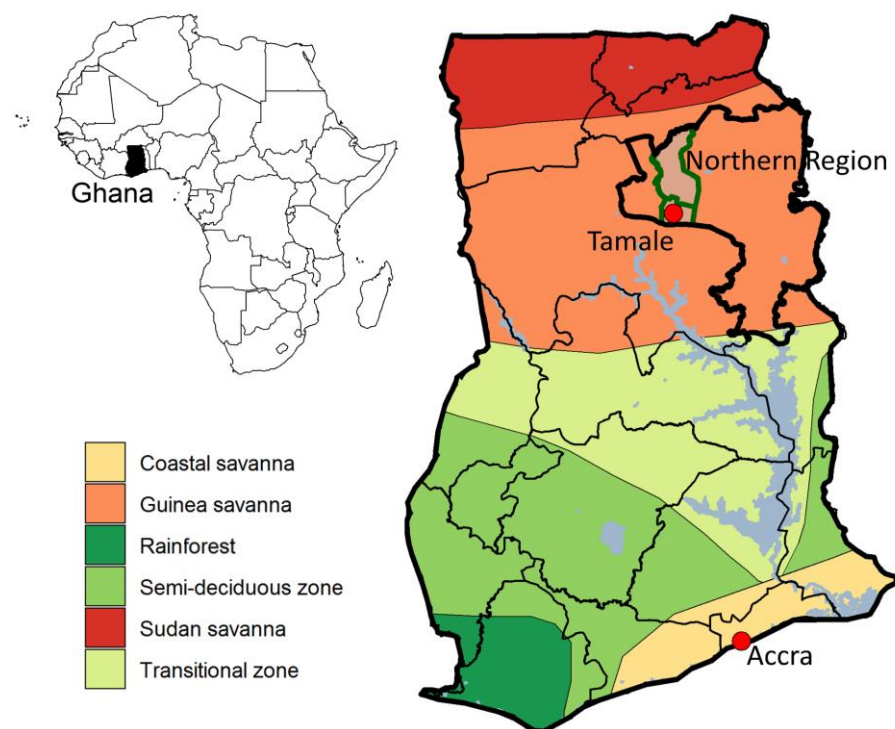


Figure 2. Map of the case study area and the agroecological zones adopted from Osei and Stein (2017).



Figure 3. Typical village setting in the Northern Region of Ghana. Photo taken by Linda Rosengren.

## Study design

The study applied an inductive and exploratory methodology using a multi-methods approach including semi-structured interviews, a participatory visual arts method (Mitchell et al., 2011) in focus groups and a debriefing method by Szyld and Rudolph (2013). The multi-methods approach was chosen to be able to obtain a rich data set on partly sensitive topics and enable co-production of knowledge. Norström et al (2020) defines co-production of knowledge in sustainability research as *“iterative and collaborative processes involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future”*. Norström et al. (2020) suggest four principles for knowledge co-production. It should be 1) context specific, 2) pluralistic, 3) interactive and 4) goal oriented. We translated these four guiding principles by Norström et al. (2020) into the study by using a case study (context specific), including informants representing different actors of the food system (pluralistic) and using participatory methods (interactive). The fourth principle (being goal-oriented) was addressed by requesting the informants to visualize a desired future regarding the topics included in the study.

The data collection included four steps: understanding, visualization, concretizing and reflecting. These steps were designed by connecting elements from three slightly separate strands of literatures, i) climate change adaptation through the work of Moser and Ekstöm (2010), ii) sustainable transformation through the work of Fazey et al (2018) and iii) systemic leverage points through the work of Fischer and Riechers (2019).

The three first steps were included in the semi-structured interviews and the participatory visual arts method while the fourth and last, reflecting, was captured by a dedicated reflection exercise during a debriefing with the project team. The data collection process included the four steps as illustrated in Figure 4.

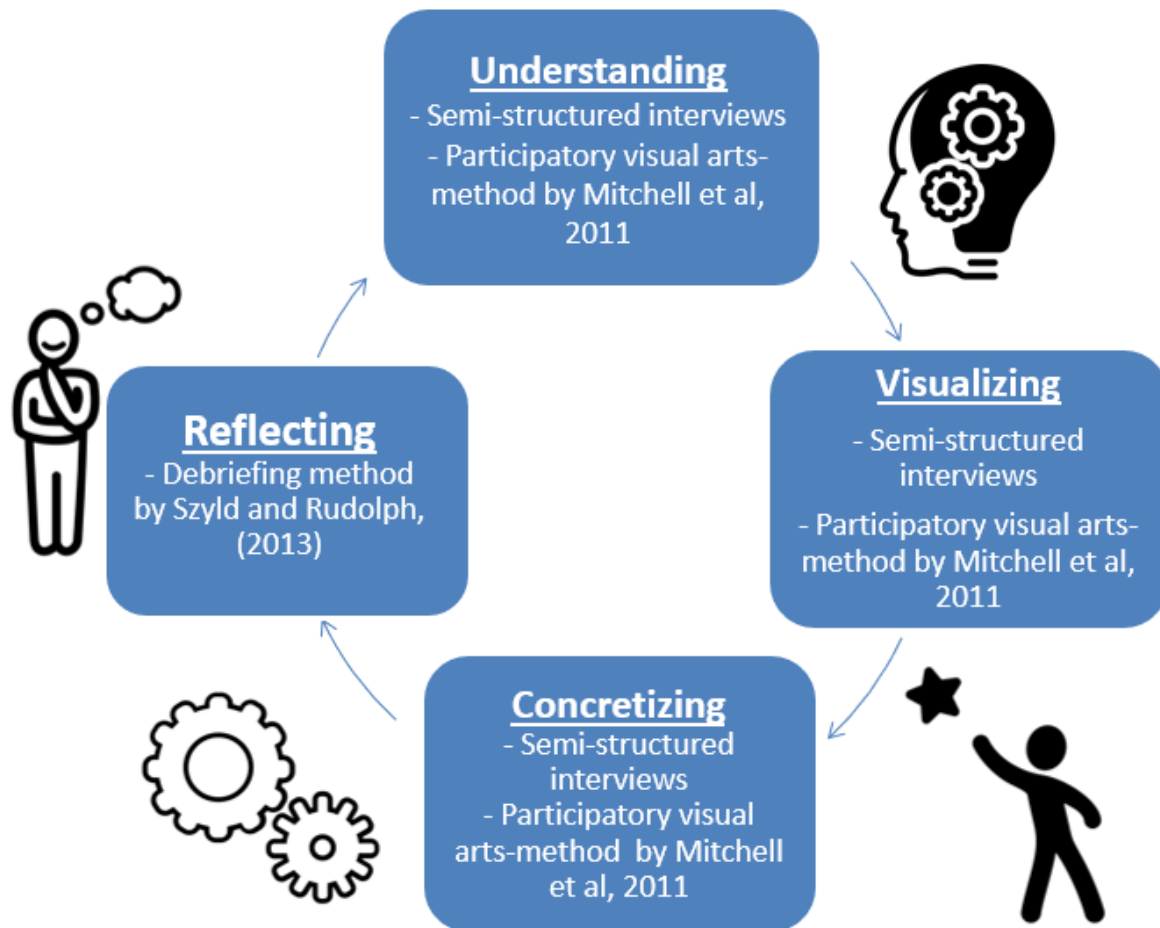


Figure 4. The figure visualizes the four steps covered in the data collection: understanding, visualization, concretizing and reflecting, and specify the methods used.

The topics included in the study consisted of the previously identified generic and place-specific leverage points listed in the Introduction chapter and visualized in Figure 1. The interview questions were framed around the place-specific leverage points while the participatory visual arts method and the reflection exercise used the generic leverage points to frame the discussion. Interlinkages between the place-specific and the generic leverage points were identified between these two levels.

## Sampling

The study included three samples: a key informant sample (n=12), a sample consisting of representatives of the local food system (n=38) and a project resource person sample (n=5). We chose these three sample groups in order to gain an in-depth understanding of place-specific leverage points and related enablers and barriers to fostering adaptive capacity as well as to gain information on how the participants envisioned the necessary changes needed for operationalizing these leverage points in a food system influenced by climate change. More broadly, the objective of including the three samples and applying the multi-methods approach was to have a rich data set including data on also partly sensitive topics such as power structures across community groups and knowledge systems.

The key informant sample included academics working in the region, a village chief, a micro-credit representative, NGO workers and a farmers' organization executive. The local food system sample contained two sub-samples: one existing of female farmers (n=20) from a village called Langa and one consisting of representatives of the local food system (n=18) including farmers, processors, retailers, a consumer representative and a representative from the local agriculture administration.

The key informant sample was formed using purposive sampling following the method presented by Tongco (2007). The local food system sample was selected based on members of two already existing Innovation Platforms. The resource person sample consisted of the resource persons of the project including the facilitators and enumerators.

## **Interviews**

Semi-structured interviews were conducted with both samples. The open-ended interview questions covered the following topics: savings groups, microcredit schemes, agriculture extension services, Innovation Platforms, and agency.

The interview team included one European and three Ghanaians. The interviews were conducted in Dagbani. All interviews were recorded upon consent given by the interviewee and translated to English during transcription.

## **Participatory visual art method**

A participatory visual art method as illustrated by (Mitchell et al., 2011) was undertaken during two focus group discussion events (n=2), one for each food system sub-sample. The visual art method was chosen to enable a rich exploration of the participants' views, perceptions and reflections in regard to the four generic leverage points: access to finance, access to and use of information and knowledge, social learning, gender equality. Also, climate change adaptation was included as an additional topic. The method allowed discussions around partly sensitive matters related to power structures of the society. The drawing exercise was used to move the attention of the participants away from the project resource persons to the topics covered. The drawing exercise was conducted in break out groups during the focus group discussion. Photos were taken of the drawings after the exercise was concluded.

In addition to the 23 drawings produced, the group discussion around the drawing was an important aspect of the exercise creating a collaborative meaning-making of the illustrations. These discussions were recorded using a recorder and by note taking done by designated reporters, one in each breakout group. The main data source used for the analysis of the study was the text, not the drawings.

Prior to the focus group discussion, a training was held with the resource team on why and how to execute the participatory visual art session. The members of the small-groups were agreed upon, the topics to be covered and the order of the topics. The order of the topics was different in each group as it was assumed energy levels of the participants would be higher in the beginning of the event.

## **Reflective session**

The final part of the data collection included a reflective session. The objective of the session was to contemplate on the discussions during the participatory visual art sessions and the interviews and reflect on the meaning of what was said. The persons participating in this exercise were the resource team including two facilitators and three enumerators. Initially it was planned that a larger group of people would participate including members of the key informant sample, but this was not possible due to restrictions related to Covid19.

The reflective work was constructed following the three phases of the so-called "Debriefing with Good Judgement" approach by Szyld and Rudolph (2013). The approach contains three phases: 1. Reaction, 2. Analysis and 3. Summary phase. The five main topics included in the study: access to finance, access to and use of information and knowledge, social learning, gender equality and climate change adaptation were discussed one at the time. The participants were asked to look back at the two visual art sessions and reflect over the following given questions:

- What are your thoughts on the findings? (reaction)
- Did something surprise you? (reaction)
- How would you describe the discussion on this topic within the group? (analysis)
- What do these results mean? (analysis)
- What can we conclude? (summary)
- What are the lessons learned? (summary)
- How can we continue the discussion on this topic in the coming Innovation Platforms?

This approach was chosen to enable articulation of underlying assumptions and beliefs of the discussions during the participatory visual art sessions and the interviews. The exercise also prompts participants to self-reflect on their own implicit judgments. The approach supported the sense-making of the outcomes of the discussions during the interviews and the focus group discussions.

### **Analyzing results across methods**

The three qualitative data collection methods lead to a total of approximately 380 pages of transcribed text that formed the basis for the analysis. The data was analyzed together as one data set without differentiating samples and methods. We chose to combine datasets across methods to have a sufficient number of responses to be able to map interlinkages between leverage points. A systematic step wise approach by Kim and Andersen (2012) to map the associations based on qualitative data was broadly applied. Their approach uses qualitative text to develop causal maps and is influenced by grounded theory. However, in our study we do not seek to infer causal relationships, but rather describe the nature of the interlinkages.

The approach includes five steps, of which we apply in the present study only the first three due to data limitations: 1) discovering themes in the data, 2) identifying variables and the relationships between them, and 3) transforming text into word-and-arrow diagrams. It is up for further research to focus on the fourth and fifth steps of Kim and Andersen's approach.

Step 1, discovering themes in the data, and step 2, identifying variables and their relationships as perceived by the interviewees, were done by conducting thematic analysis following Braun et al (2019) using NVivo software. We searched from the data instances when the participants mention an interlinkage when discussing the pre-defined leverage points and their benefits, challenges, future desires and suggestions on how to achieve the desired future state. Four variables were tracked: 1) interlinkages, 2) relationship of the interlinkages, meaning between which two elements the interlinkage is stemming from and connecting to, 3) frequency of the number of references made to each interlinkage, 4) the nature of the interlinkage meaning whether the interlinkage was framed as an enabler or barrier.

Step 3, transforming text into word-and-arrow diagrams, was done using an Internet browser-based tool called Kumu.io. The word-and-arrow diagrams present the interlinkages emerging from the place-specific to the generic leverage points. We used a feature of Kumu.io where it is possible to connect a

Google Sheet to Kumu.io and Kumu.io will based on the data generate a word-and arrow diagram. We moved the findings from step 1 and 2 into a Google Sheet document containing two separate sheets, one called "elements" and one called "connections". In the "elements" sheet we created three columns with the following headings: 1) interlinkages, 2) nature and 3) number of references. In the column called interlinkages we listed all the elements to be included in the word-and-arrow diagram including the place-specific leverage point being studied and the generic leverage points we found interlinkages to as well as the interlinkages that we got through the thematic analysis in NVivo. As Kumu.io does not permit adding a label to arrows we decided to create separate elements for the interlinkages as Kumu.io allows adding an explanation or label to an element.

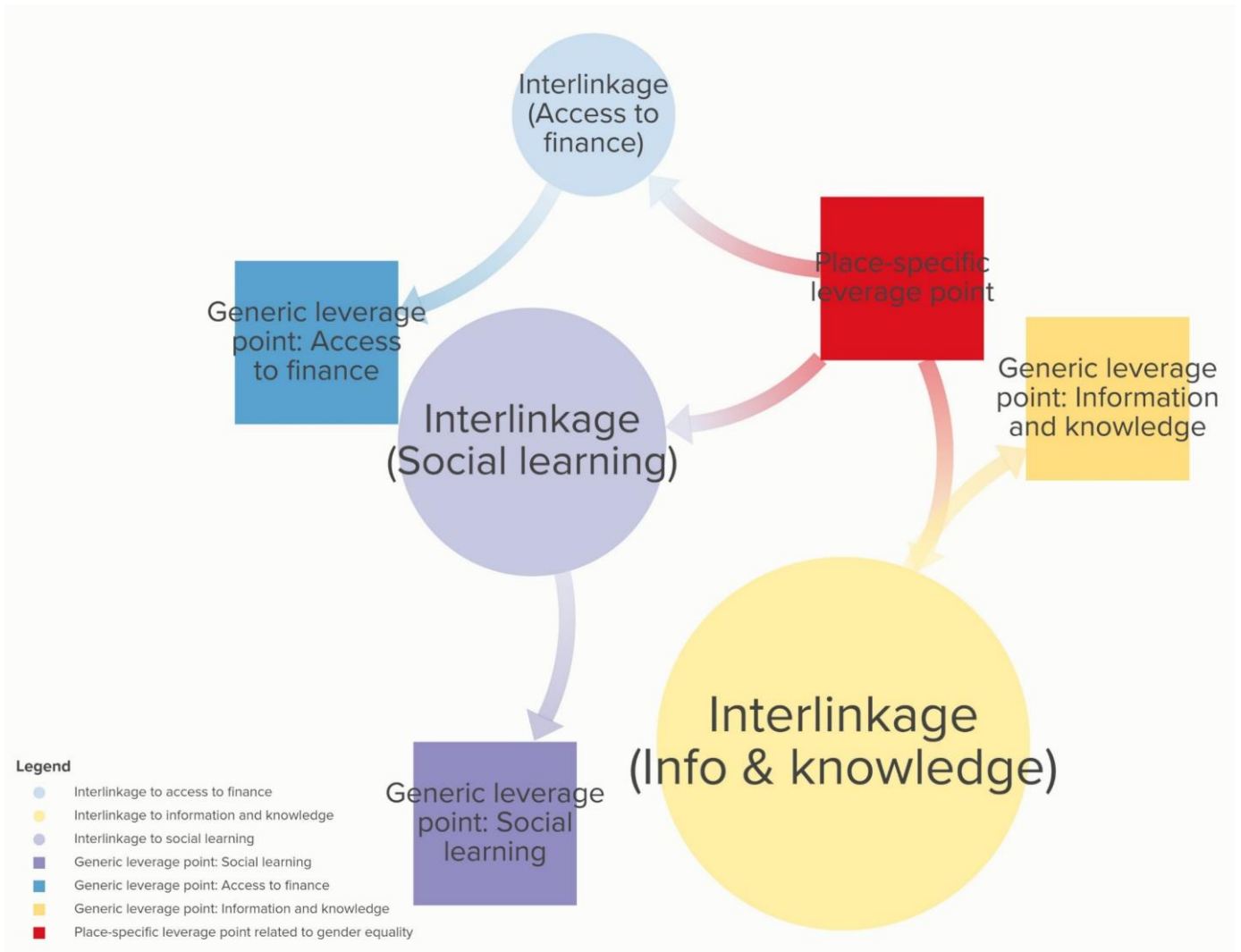


Figure 5. Example of a word-and-arrow diagram created in Kumu.io. The circles and lighter color elements are interlinkages and the squares in darker color are leverage points. The color coding is as following: blue color: access to finance, yellow color: information and knowledge, lilac color: social learning, red color: gender equality. Bigger circles indicate that there are more references to these interlinkages.

In the column called "nature" we listed whether the interlinkages were framed as an enabler or barrier in the discussions with the participants. In the column called "number of references" we inserted the number of times that the interlinkage had been referred to. The references made to a given interlinkage that arose from the participatory visual art exercise and the reflection session count as only one single reference. The references made to a given interlinkage that arose from the interviews count the number



of interviewees mentioning the topic, not the number of times in total the interlinkages were mentioned. We want to caution the reader that the number of references made is highly place- and context specific and is not generalizable. Also, we do not want to rank the interlinkages in order of importance according to how many times each interlinkage was mentioned. We consider that an interlinkage that has been referred to less may still be of importance in how it affects the system. We choose however in the results chapter to expand on the five most referred to interlinkages for each place-specific leverage point.

Based on the data from the Google Sheets Kumu.io generated the word-and-arrow diagrams. Color coding was applied in the word-and-arrow diagrams to indicate which generic leverage point a particular interlinkage was linking to. The color coding is presented in Figure 5. The shape indicates what type of element it is: a square for a leverage point - both generic and place-specific - and a circle for an interlinkage. The frequency analysis of how many informants mentioned a given interlinkage was captured in the word-and-arrow diagrams by increasing the size of the elements featuring an interlinkage with more references.

We determined the direction of the interlinkage meaning to which generic leverage point the interlinkage linked to based on what was said by the participants. For example, the following quote that emerged related to discussion concerning the place-specific leverage point "agency" that falls under the generic leverage point "gender equality" was coded as a barrier linking to the generic leverage point "information and knowledge" F230: *men and women cannot have the same worth and respect because, the men have knowledge that we women do not have.*

In some cases, a place-specific leverage point could link with multiple generic leverage points. In order not to further complicate an already complex exercise we only mention the linkage to one generic leverage point.

Context was also taken in consideration when determining which generic leverage point the interlink linked to. When we assigned the interlinkages stemming from the place-specific leverage point "savings groups" we took in consideration that the majority of the saving group members in the case study area are women. For example, we coded the following statement to link to information and knowledge of the following statement in the data F228: *Unity, support and maximum participation are the things that keep us going in the savings groups.* Knowing that the majority of the saving group members are women we linked the interlinkage to the generic leverage point "gender equality". This means that the interlinkages are highly place- and context-specific and generalization of individual interlinkages and their relationships are not generalizable.

For most of the interlinkages the interviewees hinted at a causal relationship. We choose however not to emphasize the causality as in some cases that would require more data to support it. We prefer instead to use the term association that is neutral in regard to the direction. We also do not code against the strength of the interlinkages, but we do however discuss how the interlinkages can be seen through a leverage point lens in the discussion chapter. Here we expand on our thinking related to how also an interlinkage can hold features that can affect the system in an either deep or shallow way.

When quoting statements, we indicate the sex of the respondent by marking F for female and M for male. We add the number of the participant to the letter, so it reads for example like this F305. In the result chapter we mark the number of times the interlinkage has been referred to with a number in parentheses, for example (5).

## Results

Below we present the results of Step 3, word-and-arrow diagrams, of the approach to develop a map of associations by Kim and Andersen (2012) for each of the place-specific leverage points included in the study. These are: savings groups, microcredit schemes, agriculture extension services, Innovation Platforms and agency.

### Savings groups

"Savings groups" is a place-specific leverage point belonging to the generic leverage points for strengthening the adaptive capacity called "access to finance".

Saving groups is the most common way to save, lend and manage personal money among the people living in the study area. Saving groups typically consist of a group of women congregating approximately once a week. Members of the group contribute a small amount of money each meeting that is stored in a box. When needed members can take out a loan.

Many interlinkages, a total of 22, were listed by the respondents when discussing savings groups. The interlinkages included both enablers (14) and barriers (8). The majority of the interlinkages were related to gender equality (13). This can partly be explained by the fact that the majority of the saving group members in the case study area are women. Five (5) interlinkages related to access to and use of information and knowledge and four (4) related to social learning.

The four most frequently mentioned interlinks were all enablers linking to gender equality. These four interlinkages were that the groups create "unity" among the members, they "empower" the members, that the members are "committed" and that the groups provide "support during hardship". A respondent describes the saving groups like this: (217, F) *It helps, gone are the days when we didn't know how to manage our monies well. We are able to save our monies to help grow our businesses, solve unprecedented problems and also farming activities.*

The fifth most frequently mentioned interlinkage was an enabler on the need of training on good saving group practices.

Table 1. *The table below lists the interlinkages stemming from the place-specific leverage point "savings groups". The table presents to which generic leverage point the interlinkage links to, the nature of the interlinkage (enabler/barrier) and the number of references made to the interlinkage.*

Interlinkage	Generic leverage point that interlinks links to	Nature of interlinkage	Number of references
Create unity	Gender equality	Enabler	24
Empowerment	Gender equality	Enabler	16
Create commitment	Gender equality	Enabler	15
Support in hardship	Gender equality	Enabler	12

Training on best practices needed	Social learning	Enabler	11
Usually a man as the group's accountant	Gender equality	Barrier	9
Create independence	Gender equality	Enabler	7
Improve business	Gender equality	Enabler	6
Illiteracy	Information and knowledge	Barrier	5
Lack of capacity	Information and knowledge	Barrier	5
Poor record keeping	Information and knowledge	Barrier	5
Support women	Gender equality	Enabler	4
Poor management	Information and knowledge	Barrier	4
Teaches how to manage finances	Social learning	Enabler	4
Platform for development interventions	Social learning	Enabler	3
Loan for husband	Gender equality	Barrier	2
Teaches to manage finances	Social learning	Enabler	2
Diminish girl child labor	Gender equality	Enabler	2
Enable social learning	Social learning	Enabler	2
Husband forbids wife participating in savings groups	Gender equality	Barrier	1
Facilitate access to decision makers	Gender equality	Enabler	1
Lack of transparency	Information and knowledge	Barrier	1

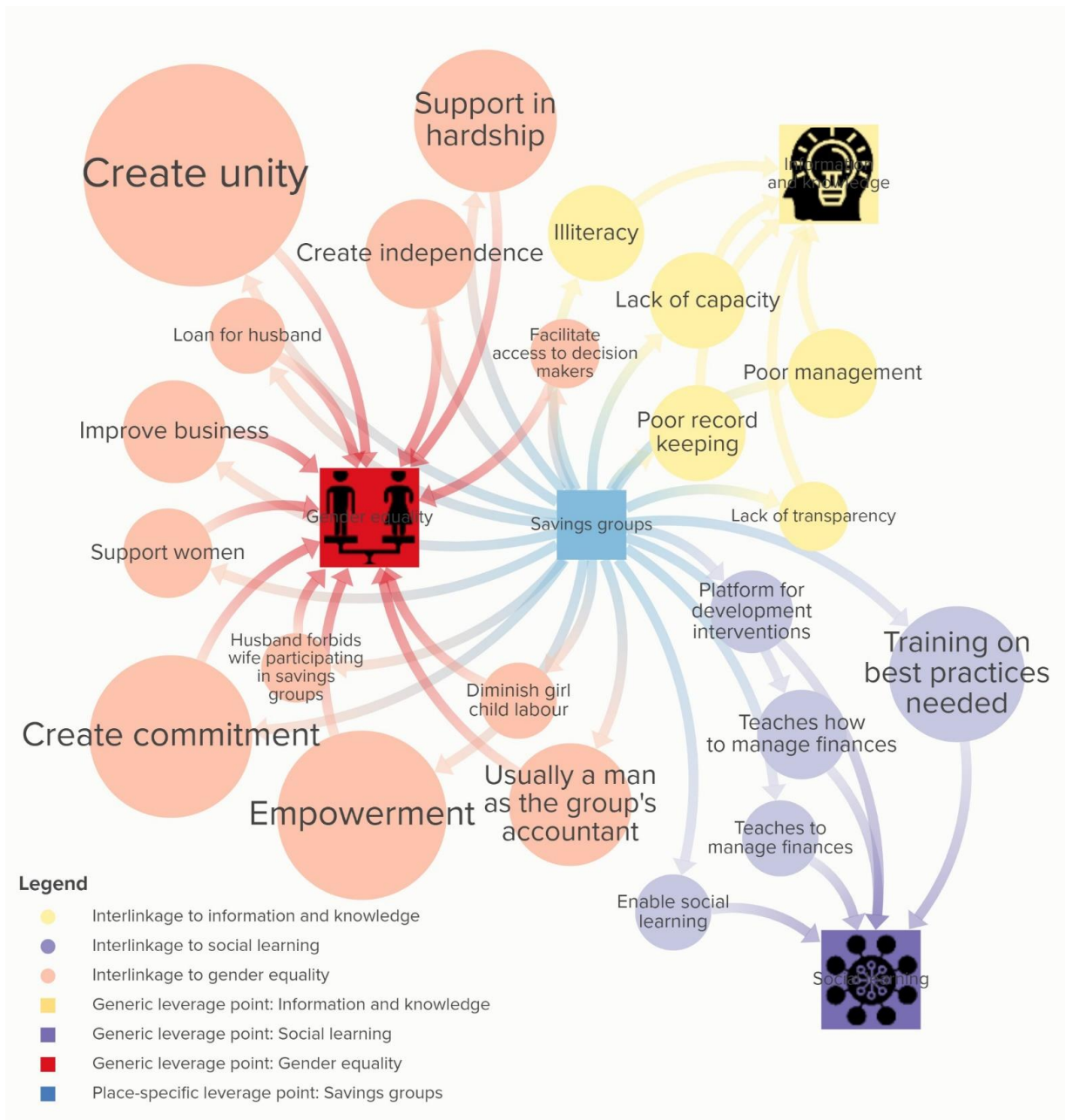


Figure 6. The figure visualizes the interlinkages stemming from the place-specific leverage point "savings groups" (blue color square) to the generic leverage points "gender equality", "information and knowledge" and "social learning". The circles and lighter color elements are interlinkages and the squares in darker color are leverage points. The color coding is as following: yellow color: information and knowledge, lilac color: social learning, red color: gender equality. Bigger circles indicate that there are more references to these interlinkages.

## Microcredit schemes

"Microcredit schemes" is a place-specific leverage point belonging to the generic leverage points for strengthening the adaptive capacity called "access to finance".

There is a plethora of microcredit providers in the case study area including several NGOs, rural banks, governmental poverty reduction programmes and private institutions. People also borrow from friends and neighbors. In this study however we limit the focus to microcredit schemes provided by NGOs and private institutions. These credit providers usually visit the communities and get acquainted with the potential credit takers while offering the credit opportunities they provide. Farmers are more likely to take a loan from these providers than visiting a bank that may feel awkward for a typical smallholder farmer that may be illiterate and not conversant with the formal bank system. While microcredit schemes offer an opportunity to invest and improve the farmers', processors' and retailers' livelihoods many respondents (31) also refer to issues relating to paying back the loan. Linked to payback problems almost equally many respondents (27) reported on how they were afraid of the consequences of not being able to pay back and afraid of feeling embarrassed and being labeled with disgrace in the community. The following statements reflect this: *(F401) People fear to default and get embarrassed with regular visits from money lenders. (F123) Most people are not strong enough to pay back and might end up defaulting and resulting into embarrassment.*

A total of thirteen (13) interlinkages emerged from the discussions related to microcredit schemes. The interlinkages included both barriers (5) and enablers (8). The interlinkages connected to all of the three generic leverage point meaning access to and use of information and knowledge (3), social learning (5) and gender equality (5).

The most frequently mentioned interlinkages were "*poor business planning skills*" that can be seen as a barrier interlinking with information and knowledge and "*training on financial management*", an enabler linking to social learning. One of the respondents describes as follows: *(F216) The problem with such people is that they do not plan before going in for these loans. Some take it and misuse the money, they do not use it for any profitable business or activity. Hence, they find it difficult to pay back.*

The second most frequently mentioned interlink stating that "*women take more credit than men*" was an enabler relating to gender equality. This can be explained by the third most frequently mentioned interlinkage that "*women have a higher repayment rate compared to men*". F117 explains this as following: *Women take credit more than men. When a woman takes credit there is this fear and she is motivated to pay back, women too do not want to be disgraced but men do not feel so, they try to show that they are strong.* This shows the inequality between the sexes and can be interpreted as a barrier but at the same time access to finance provides an opportunity for women to get economically empowered and hence be seen as an enabler.

Also on shared third place in terms of number of persons making reference to an interlinkage are the two barriers both linking to the generic leverage point information and knowledge: "Bureaucracy" and "Illiteracy". They are also strongly related to each other as the widespread illiteracy in the case study area makes the bureaucracy related to microcredit challenging.

Table 2. The table below lists the interlinkages stemming from the place-specific leverage point "microcredit schemes", to which generic leverage point the interlink links to, the nature of the interlinkage and the number of references made to the interlinkage.

<b>Interlinkage</b>	<b>Generic leverage point that interlinks links to</b>	<b>Nature of interlinkage</b>	<b>Number of references</b>
Poor business planning skills	Information and knowledge	Barrier	6
Training on financial management	Social learning	Enabler	6
Women take more credit than men	Gender equality	Enabler	5
Women higher repayment rate	Gender equality	Enabler	4
Bureaucracy	Information and knowledge	Barrier	4
Illiteracy	Information and knowledge	Barrier	4
Possibility to take care of children and household	Gender equality	Enabler	3
Creates tension among family members	Gender equality	Barrier	2
Training on good farming practices	Social learning	Enabler	1
Forming loan groups	Social learning	Enabler	1
Broaden network	Social learning	Enabler	1
Gender inequality	Gender equality	Barrier	1
Training on off farm livelihood options	Social learning	Enabler	1

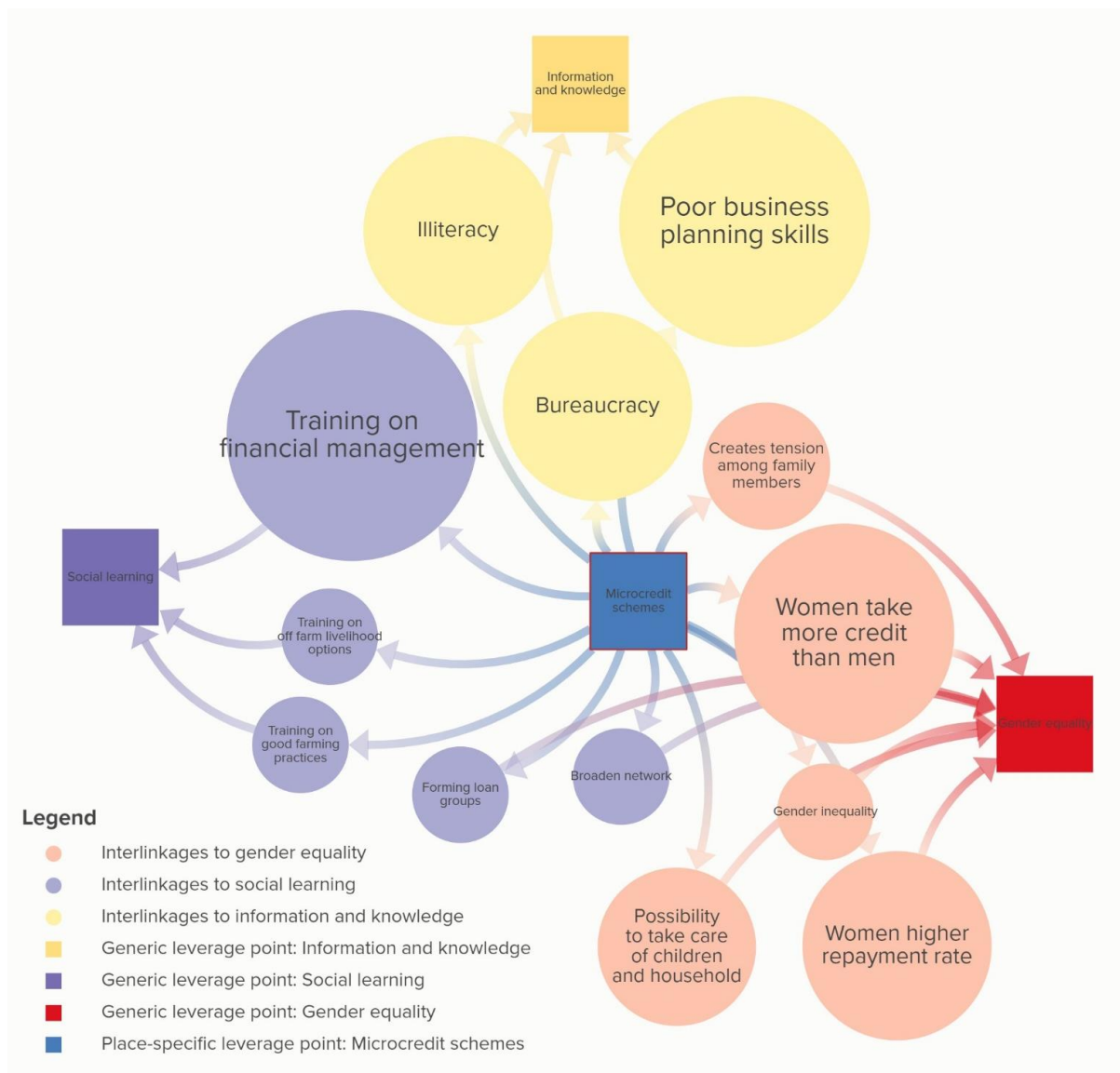


Figure 7. The figure visualizes the interlinkages stemming from the place-specific leverage point "microcredit schemes" (blue color square) to the generic leverage points "gender equality" (dark red), "information and knowledge" (dark yellow) and "social learning" (dark lilac). The circles in lighter color are interlinkages and the squares in darker color are leverage points. Bigger circles indicate that there are more references to these interlinkages.

## Agriculture extension services

"Agriculture extension services" is a place-specific leverage point belonging to the generic leverage points for strengthening the adaptive capacity called "access to and use of information and knowledge".

Access to agriculture extension services has previously been identified as a crucial source of information that supports farmers to adapt to a changing climate. Agriculture extension agents were however reported to be very few with a ratio of one agent per several thousand farmers. The farmers that the extension agents do manage to target are mostly men while women have considerably less access to extension services. A number of explanations to this emerge from the data. Generally, there is a lack of funds but there is also a clear link to "socio-cultural barriers for women to participate in agri

*extension*" (2). The absolute majority of the extension workers are male. *"Agri extension agents are not gender sensitized"* (1) which contributes to that *"male extension workers feel awkward to work with women"* (1). It was also reported that despite attempts from the governmental agriculture administration's side to be more gender inclusive in reality the *"extension agents do not bother to ensure equal participation"* (1). It was also reported that *"women grow less cash crops compared to men"* (2) as an explanation for why women have less access to extension services. Sometimes the agriculture extension sessions are organized in another community. As women have *"restricted mobility"* (1) due to religious and cultural factors it means women will have a smaller likelihood to be selected to attend the session.

A suggested intervention to improve the accessibility of women to be able to attend the extension sessions was to *"recruit more female extension agents"* (1). It was however reported that it is difficult to find suitable candidates. This is according to the respondents due to the fact that *"women are not interested in studying agriculture to become agriculture extension agents"* (3), which was the third most frequently reported interlinkage featured as a barrier to the generic leverage point gender equality. Women's lack of interest in studying to become an extension agent may be due to the fact that *"women are afraid to be mocked at the workplace"* (1) and because of that *"the job is considered as dangerous"* (1). It was not clear based on the data what the dangerous aspects are.

Agriculture extension services generated a number of interlinkages: a total of 23. The absolute majority (21) of the interlinkages relate to gender equality and the majority of these were barriers (14). The two remaining interlinkages relate to social learning which of one of the two represents the most frequently mentioned interlinkage *"knowledge dissemination"* (6), an enabler.

*Table 3. The table below lists the interlinkages stemming from the place-specific leverage point "agriculture extension services", to which generic leverage point the interlink links to, the nature of the interlinkage and the number of references made to the interlinkage.*

<b>Interlinkage</b>	<b>Generic leverage point that interlinks links to</b>	<b>Nature of interlinkage</b>	<b>Number of references</b>
Knowledge dissemination	Social learning	Enabler	6
Gender sensitization	Gender equality	Enabler	4
Separate groups for men and women	Gender equality	Enabler	4
Women not interested studying agriculture to become extension agents	Gender equality	Barrier	3
Women too busy with chores to participate in agri extension session	Gender equality	Barrier	3
Guidelines for participation in agri extension sessions	Gender equality	Enabler	3
Encourage women to enroll in agricultural studies	Gender equality	Enabler	3
Decision makers and authorities lack commitment to gender equality	Gender equality	Barrier	2



Socio-cultural barriers for women to participate in agri extension	Gender equality	Barrier	2
Women don't grow cash crops	Gender equality	Barrier	2
Quota for female extension workers	Gender equality	Enabler	2
Recruit more female extension agents	Gender equality	Enabler	1
Peer to peer learning	Social learning	Enabler	1
Agri extension agents not gender sensitized	Gender equality	Barrier	1
Extension agents not bothered to ensure equal participation	Gender equality	Barrier	1
Women afraid to be mocked at workplace	Gender equality	Barrier	1
Job dangerous for women	Gender equality	Barrier	1
Timing of extension sessions unfavorable for women	Gender equality	Barrier	1
Male extension workers feel awkward to work with women	Gender equality	Barrier	1
Extension agents busy	Gender equality	Barrier	1
Women have restricted mobility due to culture	Gender equality	Barrier	1
Women are shy	Gender equality	Barrier	1
Supervise decentralized agriculture offices	Gender equality	Enabler	1

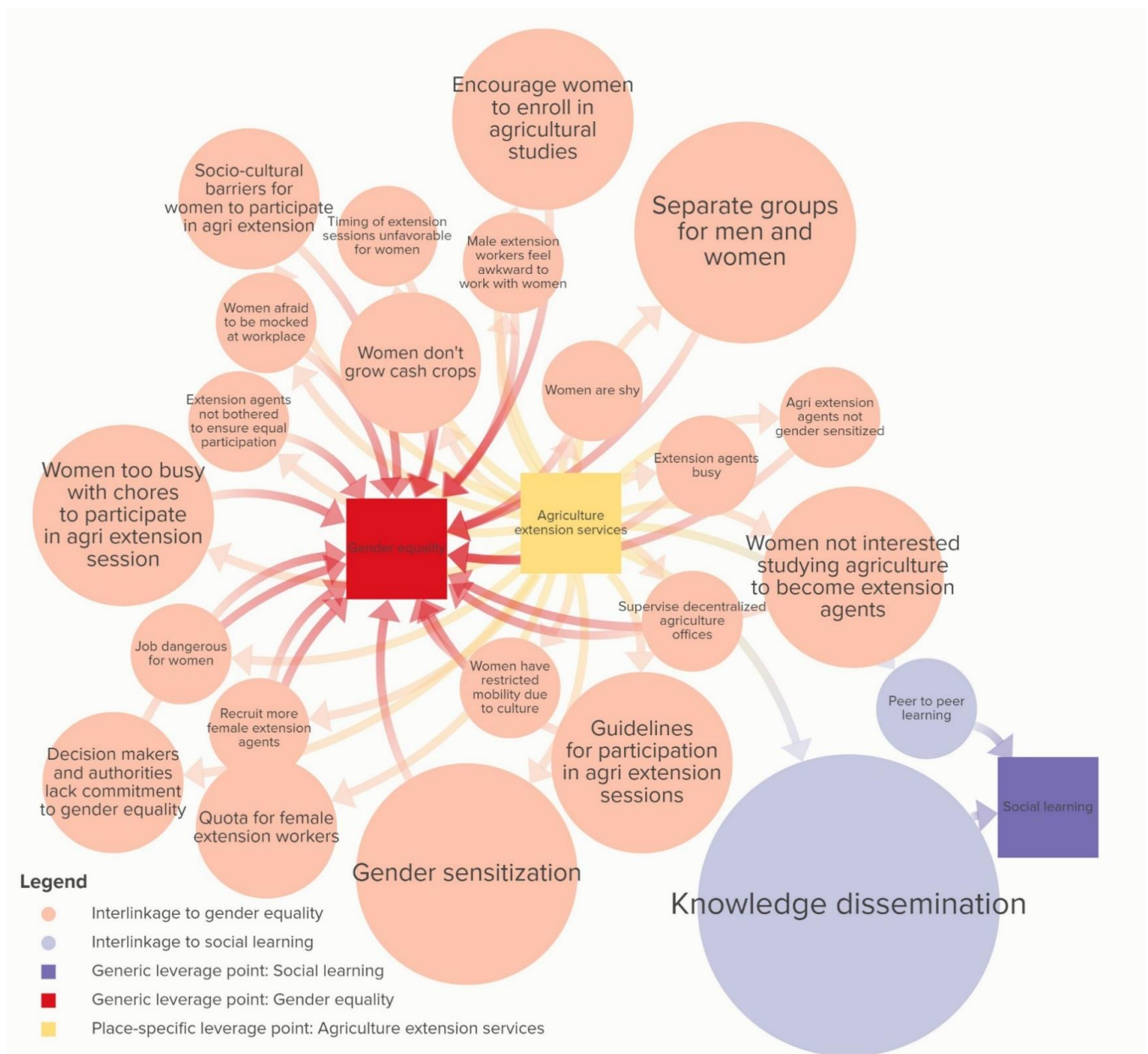


Figure 8. The figure visualizes the interlinkages stemming from the place-specific leverage point "agriculture extension service" (yellow color) to the generic leverage points "gender equality" (red color), and "social learning" (lilac color). The circles in lighter color are interlinkages and the squares in darker color are leverage points. Bigger circles indicate that there are more references to these interlinkages.

## Innovation platforms

"Innovation platforms" is a place-specific leverage point belonging to the generic leverage points for strengthening the adaptive capacity called "social learning".

Two Innovation Platforms had been established approximately one year prior to the data collection of this study. The so-called Innovation Platform-sample were all members of either of these two platforms. The Innovation Platforms had convened seven times since the platforms' establishment. The main focus of the discussions during these platforms had been the cultivation of soya beans using a particular

technology giving the possibility of higher yields. The respondents were referred to reflect on these platforms.

A total of seven (7) interlinkages were identified from the data. The interlinkages related mainly to the generic leverage point information and knowledge, two that related to access to finance and one to gender equality. Innovation Platforms was the only leverage point where only enablers, and no barriers were identified. The most dominant theme emerging from the data was the opportunity of *"building networks"* (7) that the platforms had offered, which is interlinked with access to finance. We have coded this interlinkage to interlink with access to finance based on the context of the discussions featured by the following quote: M304: *This will enhance farming practices, farmers get ideas from other actors on the food chain and also enhance agribusiness development.* Also, the third most reported interlink *"good for agribusiness"* (3) related to access to finance.

The second most frequently mentioned interlink was the possibility of *"sharing knowledge, experiences and ideas"* (4) during the Innovation Platform meetings, which like also the fourth and fifth most frequently reported interlinkage relate to access to and use of information and knowledge. The fourth most frequent interlinkage was that the Innovation Platforms had *"provided new insights"* (2) and the fifth was the fact that the Innovation Platforms had *"improved the members farming practices"* (1).

Table 4. *The table below lists the interlinkages stemming from the place-specific leverage point "Innovation Platforms", to which generic leverage point the interlink links to, the nature of the interlinkage and the number of references made to the interlinkage.*

<b>Interlinkage</b>	<b>Generic leverage point that interlinks links to</b>	<b>Nature of interlinkage</b>	<b>Number of references</b>
Build networks	Access to finance	Enabler	7
Sharing knowledge, experiences, ideas	Information and knowledge	Enabler	4
Good for agribusiness	Access to finance	Enabler	3
Provide new insights	Information and knowledge	Enabler	2
Improve farming	Information and knowledge	Enabler	1
Know and understand policies	Information and knowledge	Enabler	1
Women more empowered	Gender equality	Enabler	1

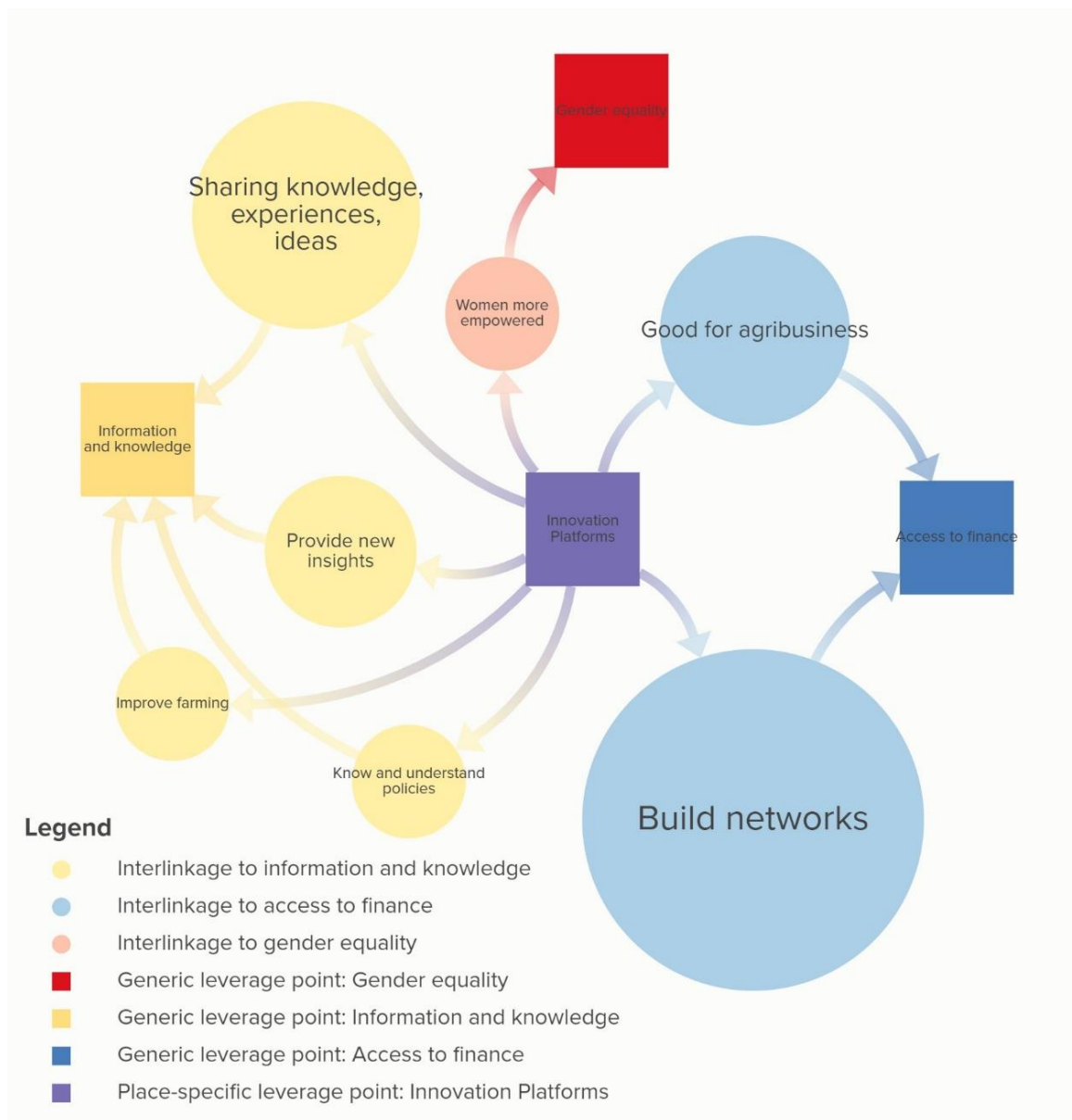


Figure 9. The figure visualizes the interlinkages stemming from the place-specific leverage point "Innovation Platform" (lilac color) to the generic leverage points "information and knowledge" (yellow color) and "access to finance" (blue color). The circles in lighter color are interlinkages and the squares in darker color are leverage points. Bigger circles indicate that there are more references to these interlinkages.

## Agency

When discussing power structures and freedom of men and women to take decision about their lives the interlinkages emerging were all except one suggestion of how to improve individuals' agency and hence coded as enablers. A total number of 11 interlinkages emerged from the data. The majority of the interlinkages linked to the generic leverage point social learning (7), three (3) linked to information and knowledge and one (1) to access to finance.

The most frequently reported interlinkage was a reference to "education"(28) holding the key according to the participants to building people's agency and making the society more equal. The second most

reported interlink was the importance of a "change in culture and traditions", (6) the third the importance of "empowerment of women"(4), the importance of "discussion"(3) and the importance of "equal participation"(3).

Table 5. The table below lists the interlinkages stemming from the place-specific leverage point "agency", to which generic leverage point the interlink links to, the nature of the interlinkage and the number of references made to the interlinkage.

<b>Interlinkage</b>	<b>Generic leverage point that interlinks links to</b>	<b>Nature of interlinkage</b>	<b>Number of references</b>
Education	Social learning	Enabler	28
Change culture and traditions	Social learning	Enabler	6
Empowerment of women	Social learning	Enabler	4
Discussion	Social learning	Enabler	3
Equal participation	Social learning	Enabler	3
Be united	Access to finance	Enabler	2
Women should know their rights	Information and knowledge	Enabler	2
Mobilizing women	Social learning	Enabler	2
Promote girl education	Social learning	Enabler	1
Radio drama on gender equality	Information and knowledge	Enabler	1
Equality impossible as men have knowledge women don't have	Information and knowledge	Barrier	1

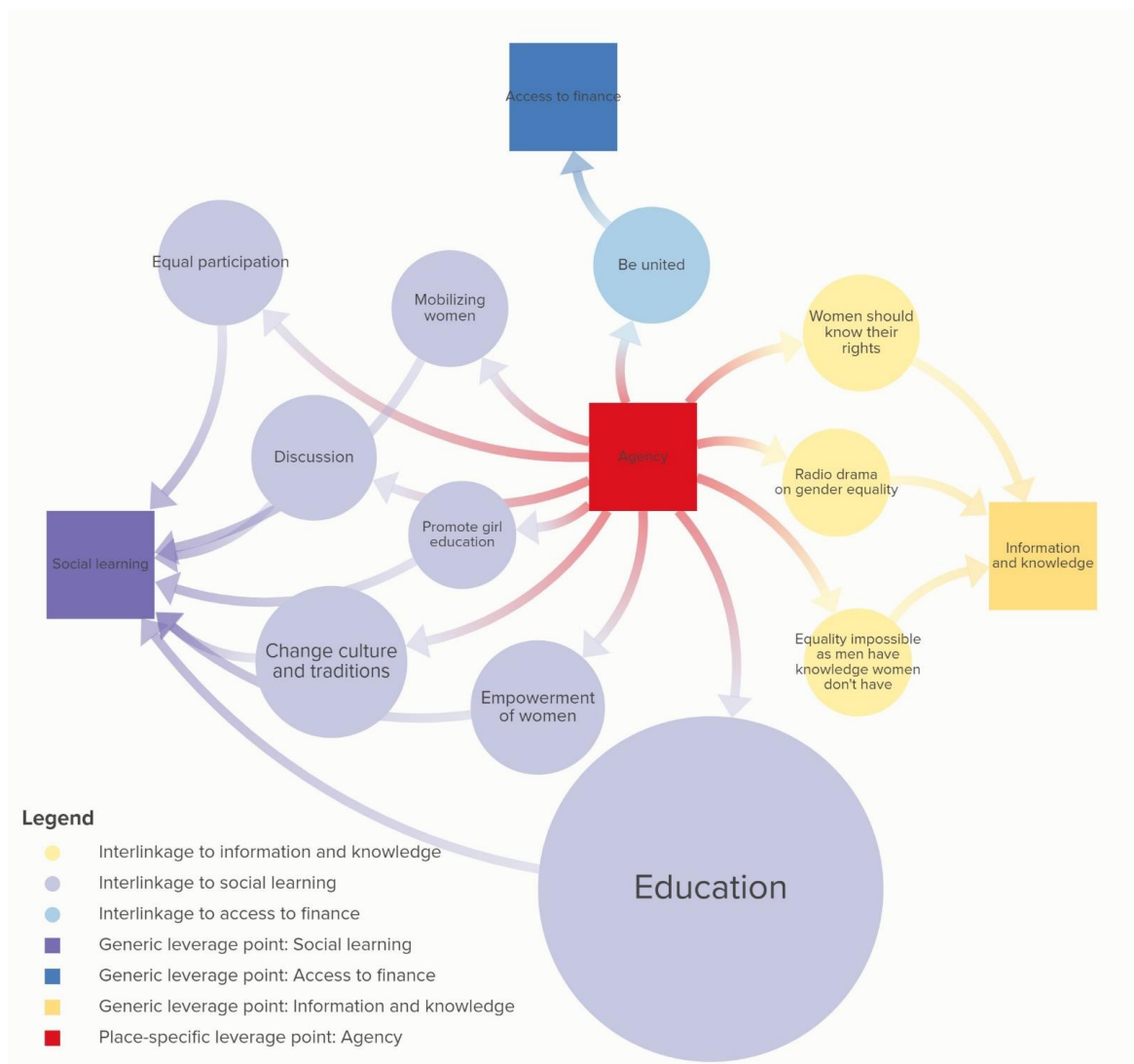


Figure 10. The figure visualizes the interlinkages stemming from the place-specific leverage point "agency" (red square) to the generic leverage points "social learning" (lilac color), "access to finance" (blue color) and "information and knowledge" (yellow color). The circles in lighter color are interlinkages and the squares in darker color are leverage points. Bigger circles indicate that there are more references to these interlinkages.

Table 6. The table summarizes the results presenting the total number of interlinkages for each of the five place-specific leverage points being studied as well as to which generic leverage point, they interlink with and whether the interlinkages were enablers or barriers

Place-specific leverage point	Number of interlinkages	Interlinkages with generic leverage points	Nature of the interlinkages
Savings groups (Access to finance)	22	Gender equality: 13 Info and knowledge: 5 Social learning: 4	Enablers: 12 Barriers: 9
Microcredit schemes (Access to finance)	13	Gender equality: 5 Info and knowledge: 4 Social learning: 5	Enablers: 7 Barriers: 6

Agriculture extension services (Info and knowledge)	23	Gender equality: 21 Social learning: 2 Access to finance: 0	Enablers: 7 Barriers: 17
Innovation Platforms (Social learning)	7	Info and knowledge: 4 Access to finance: 2 Gender equality: 1	Enablers: 7 Barriers: 0
Agency (Gender equality)	11	Social learning: 7 Access to finance: 1 Info and knowledge: 3	Enablers: 10 Barriers: 1

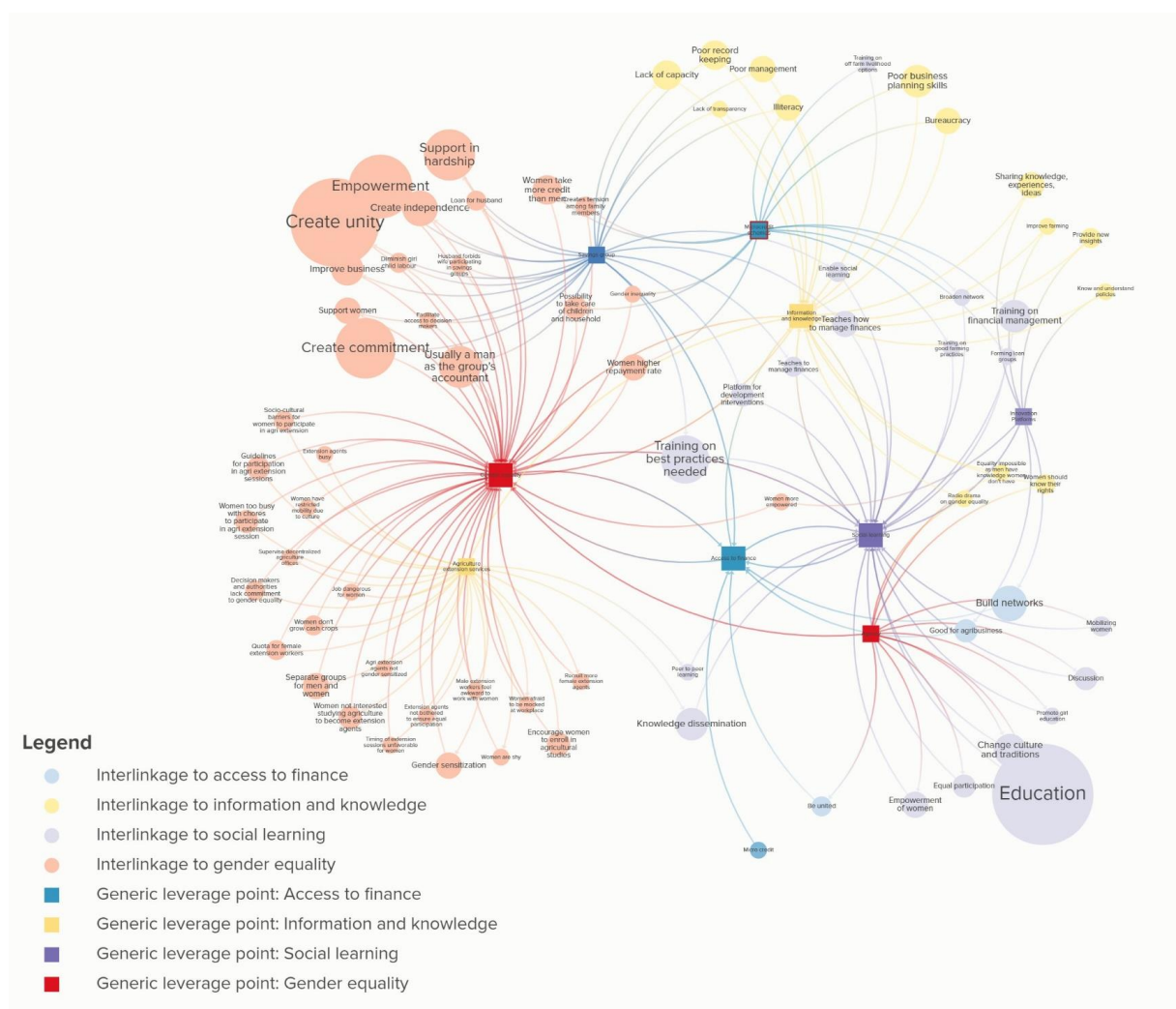


Figure 11. The figure visualizes all interlinkages stemming between the five place-specific and the four generic leverage point. The aim of this figure is not for the reader to be able to distinguish each element but rather convey that here is a rich web of interlinkages.

## Discussion

We found three ways that interlinkages stemming from leverage points affect the system and therefore have the ability to play a role in how desired change unravels. First, interlinkages can enable or hinder another leverage point. Second, interlinkages can instigate feedback loops. Third, interlinkages can affect the system in different levels of depth. These three features of the interlinkages make them highly relevant for transformation and sustainability science.

### **Interlinkages can enable or hinder another leverage point**

Through discussions with the study participants, we identified interlinkages between the place-specific and generic leverage points that can be seen as either enablers or barriers. For example, when discussing the place-specific leverage point "Innovation Platforms" the most frequently reported interlinkage was that the platforms help to "build networks". This was framed as a benefit that has the potential to improve business. We coded "build networks" as an enabler to the generic leverage point "access to finance" as poor business was mentioned as reasons holding people back from taking credit.

An example of a barrier is the interlinkage "poor business planning skills" that was the most frequently reported interlinkages stemming from the discussions on the place-specific interlinkages "microcredit schemes". Poor business planning skills interlinks with the generic leverage point "access to and use of information and knowledge".

The interlinkages that we have identified may be interpreted also to link with another of the three generic leverage points. In another context some of the interlinkages may also hold a different nature, being a barrier instead of an enabler. Both the direction of the interlinkage, meaning to which leverage point it links to, and the nature of it may also change if there are changes in the system. However, what we want to bring forward with this study is that interlinkages exist, and they hold a specific nature by which they affect the system. The focus of the present academic discussion related to interaction between leverage points have been focused on how one leverage point, mainly shallow, can enable another, mainly deep leverage points (Fischer, Riechers, 2019, Manlosa et al., 2019). In policy and intervention planning it is however equally important to be mindful of the fact that the interaction can hamper a leverage point to work at its full potential.

### **Interlinkages can instigate feedback loops**

Feedbacks are one realm of leverage points including the following three types of leverage points: i) length of delays, relative to rate of system change, ii) strength of negative feedback loops and iii) gain around positive feedback loops (Meadows, 1999, Abson et al., 2017) . As seen in the results, interlinkages create a web of interaction between the related leverage points. We claim that these interlinkages can instigate feedback loops, which makes interlinkages instigators of leverage.

Employing the causal loop diagram method and based on the word-and-arrow maps built from the empirical data collected in the case study area, we designed a generalized diagram of how the four generic leverage points are interlinked and how they contribute to strengthening adaptive capacity. The diagram, presented in Figure 12, visualizes how the generic leverage points strengthen adaptive capacity through reinforcing feedback loops by affecting the five main domains of adaptive capacity according to Cinner et al (2018). The five main domains are: assets, flexibility, social organization, learning and agency.

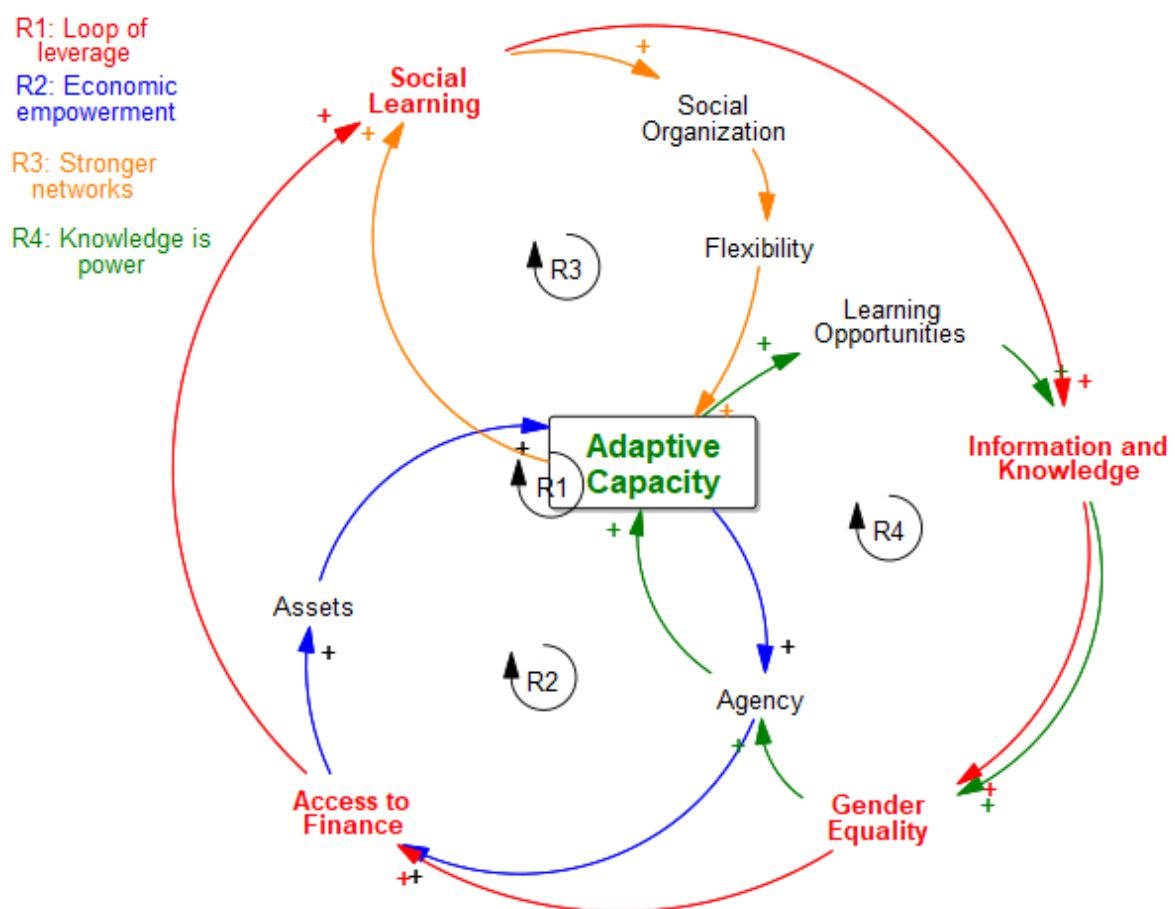
The generalized causal loop diagram features four reinforcing feedback loops that we describe below. We mark the loops with capital "R" and a number. The capital "R" stands for "reinforcing" as per the



practice in causal loop diagrams. The number is added to differentiate the four loops. The causal map includes the following four feedback loops: R1: Loop of leverage, R2: Economic empowerment, R3: Stronger networks and R4: Knowledge is power.

The diagram is a simplification and presents only a fraction of all possible interlinkages and feedback loops. We contend that these four feedback loops are the most meaningful in conveying the message of how the four leverage points are interlinked and how they strengthen adaptive capacity. We moreover argue that this generalized causal loop diagram applies beyond the case study area.

Figure 12. The figure visualizes four reinforcing feedback loops R1: Loop of leverage, R2: Economic empowerment, R3: Stronger networks and R4: Knowledge is power.



### R1: Loop of leverage

Linkages between the four generic leverage points formed a reinforcing feedback loop. The feedback loop can be briefly explained as follows: social learning enables the access to and use of information and knowledge. Being able to access and use relevant information and knowledge strengthens gender equality. Gender equality empowers women to actively engage in new livelihood opportunities and seek financing for the seed funding. Empowered women are more prone to access finance opportunities. Access to finance increases economic empowerment which increases the likelihood to seek out new social learning opportunities.

## **R2: Economic empowerment**

The linkage between access to finance, assets, adaptive capacity and agency forms a reinforcing feedback loop that strengthens adaptive capacity and economic empowerment. The feedback loop can be briefly explained as follows: access to finance enables people to acquire assets such as tools and equipment needed to diversify one's livelihoods. This will strengthen the adaptive capacity of the person which will lead to stronger agency. Stronger agency of a person will spur the person to find out opportunities to access further funding to be able to buy more useful equipment.

## **R3: Stronger networks**

The linkage between social learning, social organization, flexibility, adaptive capacity and adaptive capacity forms a reinforcing feedback loop that strengthens adaptive capacity and forms stronger networks. The feedback loop can be briefly explained as follows: social learning facilitates social organization meaning people are able to create new and deeper networks that opens up opportunities for collaboration, collective action and knowledge sharing. This again will enable more flexibility in terms of finding new partners to collaborate with and new ideas on how to improve or diversify one's livelihoods. Improved flexibility will lead to stronger adaptive capacity and stronger adaptive capacity will spur the person to find new social learning opportunities.

## **R4: Knowledge is power**

The linkage between learning opportunities, information and knowledge, gender equality, agency and adaptive capacity forms a reinforcing feedback loop. The feedback loop can be briefly explained as follows: having different types of opportunities to learn will lead to an improved access and use of information and knowledge. Being able to access and use relevant information and knowledge strengthens gender equality. Improved gender equality will strengthen agency, which again will improve adaptive capacity, which again will spur the person to seek new learning opportunities.

## **Interlinkages can affect the system at different depths**

Interlinkages found in the data hold a specific nature being either enablers or barriers vis-a-vis another related leverage point. We contend that the interlinkages can also be seen through a leverage point framework lens. By looking at the interlinkages through this lens we can see that the interlinkages affect the system in either a deep or shallow way. We consider that many of the interlinkages that we present in the result chapter hold the potential to affect the system in a "deep" way. We give some examples below to illustrate this.

In the case of the place-specific leverage point "savings groups" the most frequently mentioned interlinkage was that the saving groups create unity. We contend that this interlinkage can affect the system in a "deep" way as it can be related to Meadow's leverage point framework to "the power to add, change or self-organize system structure" which is a deep leverage point.

Another example that can be mentioned is an interlinkage that "women are not interested in studying agriculture to become extension agents" that emerged from discussions related to place-specific leverage point "agriculture extension services". The discussion revolved around the fact that women engage less with agriculture extension services compared to men, despite that women do a large share of the farming activities in the case study areas. This leads to women missing out on important information and knowledge related for example with how to adapt the farming activities to the changing climate. It was stated that because the extension agent in most cases is a man it makes it difficult for women to attend the extension sessions and interact with the extension agent due to socio-cultural structures. Hiring female extension agents has however proven difficult as, according to the interviewees, women are not interested in studying agriculture to become extension agents. That

women are not interested in studying agriculture to become extension agents is a barrier to gender equality. In addition to that we can also view the interlinkage through the leverage point lens and conclude that this interlinkage affects the system in a “deep” way. It can be related to Meadow’s leverage point framework to “the mindset or paradigm out of which the system arises” which is the second deepest of the twelve leverage point levels.

By targeting interventions or *levers* as per the leverage point literature, decide to act upon a given leverage point will partly determine how deep the impact will be. In that sense it can be claimed to be too simplistic to use a dichotomy of deep and shallow leverage points. But in broad terms we can say that some features can be more naturally linked to deep leverage points while others to more shallow leverage points. As stated in the Introduction, recent studies including Riechers and Fischer (2019) and Manlosa (2019) suggest that shallow leverage points can create an enabling environment to tackle deep leverage and possibly ignite a so-called “chain of leverage”. We do not disagree with this view, but we contend that interlinkages between related leverage points play a key role in igniting, or hindering, the creation of a “chain of leverage”. Or as shown in the results of this study the interlinkages may rather create a “web of leverage”. We contend that the interlinkages contribute to creating this so-called “web of leverage” through the three ways we suggest they affect the system: by either enabling or hindering another leverage point, by creating feedback loops and by affecting another leverage point in a deep or shallow way. We suggest further research to explore and test the role of the interlinkages in amplifying desired change.

## Conclusion

The aim of the paper was to explore how interlinkages between leverage points for strengthening adaptive capacity influence the mechanisms to generate desired change. We do this by studying the nature and depth of the interlinkages. The results showed that there is a rich web of interlinkages stemming from the place-specific leverage points to the generic leverage points. The interlinkages were either enabling or hindering a related generic leverage point and they affected the system in a both deep and shallow way.

Based on the findings of this study we draw three conclusions relevant for policymakers and climate change adaptation planners. First, understanding how certain related leverage points interact with each other is important as the interaction between the leverage points may determine how well the policy or intervention will succeed in creating the desired change. Second, choosing leverage points that create synergies and enable each other may amplify the desired change the policy or intervention seeks to achieve. On the other hand, acting on one leverage point may create trade-offs vis-a-vis another related leverage point. Third, interlinkages may affect the system in a “deep” way and prepare the ground to act also upon deep leverage points that normally are difficult to act on.

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