

Advancing Understanding of Socio-Ecological Approach to Livelihoods

*A Facilitation Manual for Group Model Building
Learning Workshop with Village Communities*



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Practitioner's Manual

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1. Introduction

Dominant trends of livelihood development in rural areas focus on intensification of agriculture production through mono-crop cultivation, irrigation, application of fertilisers and pest control. Often, such approaches disconnect farms from farming system, and people from nature, leading to the degradation of natural resources and deterioration in soil health, water resources, and biodiversity, and the long term viability of rural livelihoods. Further, the lack of appreciation of diverse social-economic-ecological contexts and the need to evolve locally adaptive solutions have resulted in standard prescriptions and 'one-size-fits-all' approach. An increasing need is felt to change the lens through which we see the challenges of strengthening rural livelihoods – from a 'linear approach' of income enhancement through delivery of 'one-size-fits-all' solutions to a 'systems approach' that draws on the positive synergies offered by social and natural systems and enables the capacities of local communities to collectively search for locally adaptive solutions that can make their livelihoods more resilient.

This manual is an attempt to provide practitioners working at intersection of small holder agriculture, livelihoods and conservation, and communities embedded in those ecosystems with a tool to better understand the architecture and interconnections of complex self-adaptive systems. It provides process steps to guide participatory group model building activities with village communities through a community based system dynamics approach to deepen mutual understanding of how social, ecological and economic resources interact in varied contexts and inform the pathways for livelihood improvement from a system's perspective.

The community based system dynamics presented in this manual is a tool that helps identify key cause and effect relationships and prepare village communities (and other actors) to foresee the effect (intended and unintended) of actions undertaken and take more informed decisions. The tool provides a process to map the different mental models guiding specific actions and engage the community to understand and enable sustainable socio-economic and ecological processes and outcomes. It helps convene different actors in the village and outside; decide on key resources and interconnections; provide a visual means and a common framework to discuss different mental models; analyse causal factors and structures guiding the behavior; and contemplate designs and identify interventions to build robust social-ecological livelihood systems. However, system's thinking is not a panacea, and its application may not resolve complex problems so easily. While it may provide some quick successes at micro level, with some communities establishing their socio-ecological criteria, demonstrating the social and ecological linkages and identifying interventions for socio-ecological sustainable livelihoods, the changes needed are not just at community level. There is a need for enhancing human capacities among various actors at the Block and District, and State and Union Government levels, and convene processes at different scales for a system wide shift.

The manual is a result of collaborative efforts by Boston College, Washington University in St. Louis and Foundation for Ecological Security in improving the understanding of socio-ecological approach to livelihoods (SEAL), and builds on the experiences and insights drawn from the Community Based System Dynamics Workshops undertaken with village communities in Angul (Odisha), Bhilwara (Rajasthan), Kolar (Karnataka) and Udaipur (Rajasthan).

2. SEAL and CBSD

2.1 Socio-Ecological Approach to Livelihoods (SEAL)

Socio-Ecological Approach to Livelihoods (SEAL) aims to provide an alternative narrative to the livelihood discourse in India, one that moves beyond seeing livelihood as solely an economic function to incorporating both the ecological and social functions, and the dynamic interactions between these components as critical to livelihood outcomes. The SEAL framework highlights that surfacing and acting on the inter-linkages of natural and social systems through local self-governance institutions offers immense potential to improve the ecological health, and the social and economic well-being of village communities. It incorporates social systems and governance arrangements, which are fundamental to the interaction between natural and human systems as its key components. Collective action and a code of locally agreed norms help mediate interaction between natural and human systems through crafting and monitoring rules for resource usage. Besides capturing the economic outcomes from well-functioning and resilient ecosystems in terms of stable rural production systems and contributing to improved productivity, it suggests insulating measures to keep in check undesirable drivers that could affect the state of ecological services and functions.

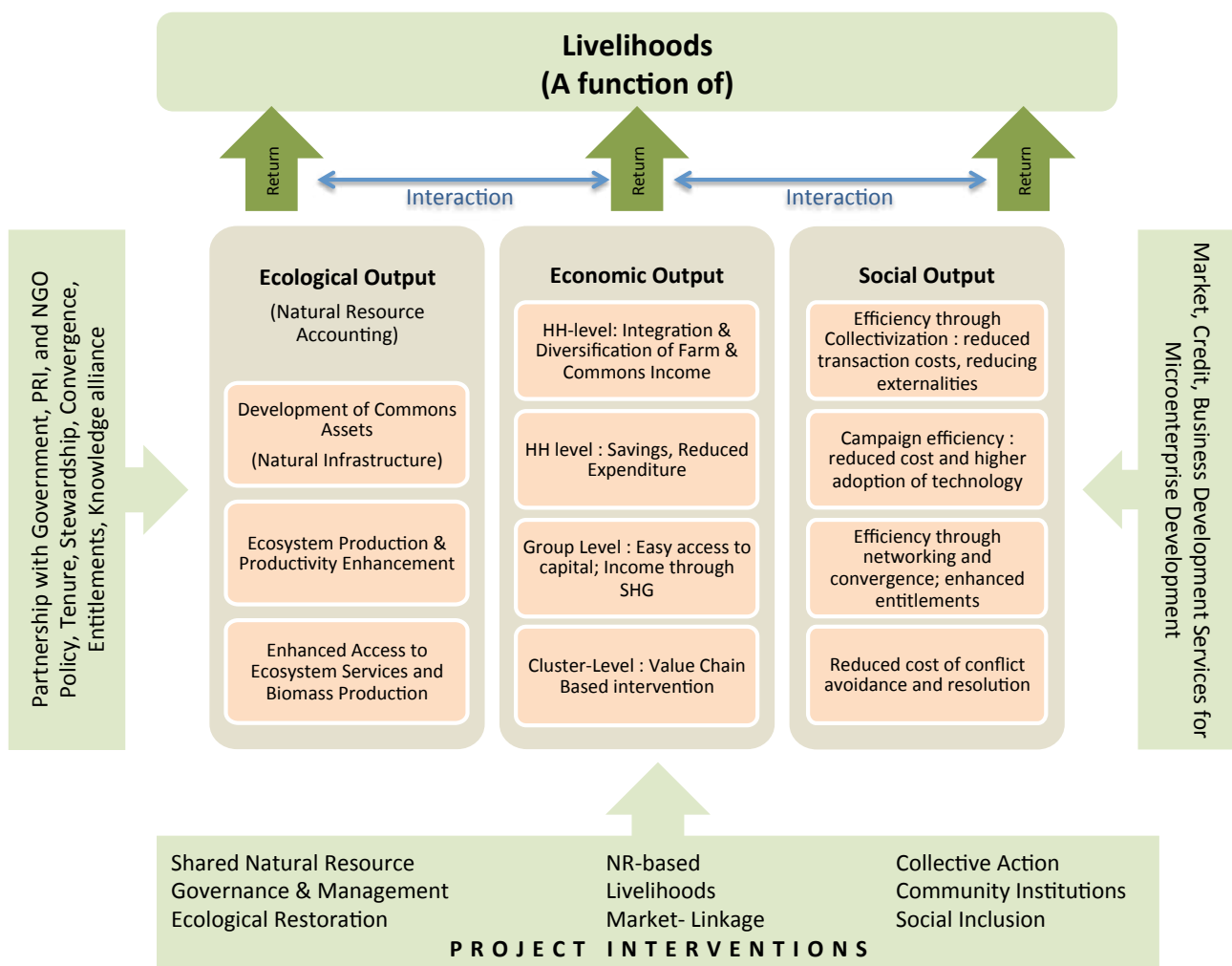


Figure 1: SEAL Framework



2.2 Community Based System Dynamics

System dynamics uses informal maps and formal simulation models to understand how complex systems change over time from an endogenous or feedback perspective (Richardson, 2011). It provides a common language and diagramming convention that allows a wide range of participants, including communities and organizations, to visually depict interactions in a connected social, ecological, and economic system.

Community Based System Dynamics (CBSD) is an outgrowth of the system dynamics modeling tradition that builds on the group model building (GMB) process of engaging people in the activity of modeling systems. CBSD places an emphasis on communities' perspectives and on building their capacity to understand and use models (Hovmand, 2014). It draws on a mix of methods such as Participatory Rural Appraisal and Group Model Building, offering scope for visual representation of mental models of the community in the form of informal causal maps and formal models that can be simulated on a computer to understand the different interconnections in a system better.

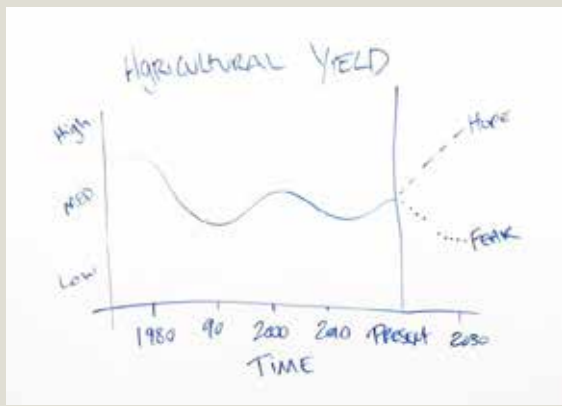


Figure I: Example Behavior Over Time Graph

Box 1: Brief on System Dynamics

System behavior is how a system changes over time. Behavior over time graphs (BOTGs) describe this behavior, including hoped and feared for future behavior. Figure I shows an example BOTG of agricultural yield changing over time.

We want to understand what is generating the behavior over time in the community. System dynamics argues that behavior is driven by feedback loops, or interactions where effects feed back to influence the causes. We can depict those interactions using models.

Figure II shows a causal loop diagram (CLD) that could begin to explain the behavior in Figure I. The words represent variables that can change over time. The lines with arrows represent causal connections. Arrows with a "+" sign indicate a positive causal connection where if the cause increases the effect increases. For example in Figure II, if the amount of fodder increases then the number of livestock increases. Arrows with a "-" sign indicate a negative causal connection where if the causes increases the effect decreases. For example in Figure II, as migrating increases then the number of people in the village decreases. The double lines crossing the line with the arrow represents a delay between the cause and effect. As the number of people in the village decreases, the agricultural yield will decline because there are fewer people to work the land. However, this effect won't be noticed until after some time.

There are two kinds of feedback loops, reinforcing loops and balancing loops. Reinforcing loops are where an action creates more of the same action resulting in growth or decline. For example, as agricultural yield increases, the amount of fodder increases. As fodder increases, the number of livestock increases which increases the amount of manure available. As manure increases, agricultural yield increases, reinforcing growth. Balancing loops push back or limit more of the same action. For example, as agricultural yield increases, income increases. With greater income, access to education increases resulting in more migration. As migrating increases, people in the village decreases. As the number of people in the village decreases, there are less people available to work the land which limits agricultural yield.

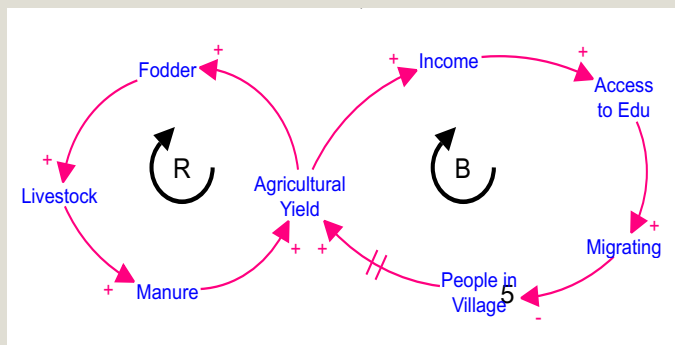


Figure II: Example Causal Loop Diagram

2.3 How can CBSD help advance understanding of SEAL?

While SEAL is a framework organizing a general set of variables of natural and community resources, and contextual variables used for diagnostics, scientific inquiry, evaluation and policy, how to achieve sustainable socio-ecological livelihoods is a community *theory* about the process for achieving a desired set of outcomes over a defined period of time. Diversity in community contextual characteristics, resources, *and* how they are or could be organized represent different theories of how to achieve sustainable socio-ecological livelihoods (Hovmand, 2017)¹.

1. Hovmand, P. (2017, August). Modelling as Theory Development for Sustainability & Social Justice. Presented at Anand, Gujarat, India



Social and ecological systems within which livelihoods are knitted are open, complex and self-adaptive systems that have inherent capabilities to evolve over time. In order to aid communities in achieving sustainable socio-ecological livelihoods, it is important to understand the structure of the system (in which it operates) to tailor interventions that would best operate within the system. Therefore, it is necessary to strive to understand communities' perspectives of the resource systems as well as the perspective of organizations who are designing interventions for those communities. As contexts and interactions between different components of the system differ, the knowledge of the structure of a system and what matters most in a particular context is likely to come from experiences within the locality. Thus, while defining the pathways for livelihood improvement, the local communities must become the discoverers and owners of their solutions.

CBSD provides a way for communities to:

- Explicitly *describe* their current theory of resource systems and how these are related to longer term outcomes;
- *Understand* how their current theory is / is not sustainable;
- *Compare and learn* from theories across community contexts and levels of aggregation;
- *Contemplate* designs for achieving socio-ecological sustainable livelihoods
- Through analysis, *identify* policies that can help communities deal with uncertainties.

3. The Manual

The Manual has been developed as a facilitation guide for conducting Group Model Building Learning Workshops with village communities to advance understanding of SEAL and develop causal maps of socio-ecological interactions in varied contexts using CBSD. These workshops are divided in five sessions that should be conducted in a sequential manner over a period of four to six months with the same village community. The manual provides a detailed agenda for each of the five sessions mentioned below. The agenda for each of the sessions is primarily divided in three parts:

- i. Defining the objective of the meeting and setting the tone for the group model building activity to be undertaken on that day;
- ii. Conducting the activity (such as resource elicitation, behavior over time graph, or causal loop diagram etc.);
- iii. Summarizing the discussions during the exercise and then sharing the next steps.

Further, a checklist of materials required for the activity and outputs from each of the sessions are also included.

Below is a brief overview of the various sessions and group model activities to be undertaken:

- **Session 1: Resource Elicitation** – This session aims to identify the key social, ecological and economic resources in the village and understand how different stakeholders in the village prioritize these resources. It helps in a Resource-Based View of the social and ecological system helping communities to reconfigure resource dynamics to create better outcomes. The facilitation team during this session should also clearly communicate the larger idea of a SEAL and set the tone for conducting the various group model building activities that would span over the next couple of months.
- **Session 2: Trends over time** – This session aims to understand how the key resources (as identified and prioritized by the community in the previous session) have changed over time and what are the communities' hopes and fears for future. The facilitation team at the end of this session should also ask the community to nominate members who would participate in a more focused discussion on the inter-connections between different resources (in the next session).
- **Session 3: Causal Loop Diagram** – This session aims to identify how the key resources (identified in the previous sessions) are interconnected and elicit communities' stories behind these interconnections. The facilitation team should help the participants in preparing a visual representation of the causal relationships between the different resources and variables through this session.
- **Session 4: Refining the Causal Loop Diagram** – This session aims to refine the connections between key resources and variables, identify the feedback loops (in the causal loop diagram developed during the previous session) and see how these relate to the behavior over time graphs and the stories narrated by the community.
- **Session 5: Validating the Causal Loop Diagram** – This session aims to revisit the connections between key resources and variables with a focus on validating the narratives and revising or closing the feedback loops. The facilitation team should especially focus on pitching the discussions during this session in the larger framework of SEAL and probe the participants to understand their perspectives on the opportunities and constraints for livelihood improvement.

Note: Sessions 1-4 can take place with a few days in between, depending on the availability of community members. Session 5 should take place after some time, preferably after several months.

3.1 Facilitation Team Roles

Convener – This person should be a field staff member who is familiar with the village community. His/her role is to welcome participants, introduce the purpose of the meeting, manage expectations, think through choices about who to include with consideration to the interpersonal or political dynamics among participants, and answer questions about next steps and timelines.

Facilitator – This person is responsible for giving instructions for activities, providing prompts, and asking probing or follow up questions. The facilitator has a heavy load during the workshop – he or she is the lead voice who is running the session, managing boundary objects, and keeping track of participation dynamics. The facilitator should ideally be able to communicate in the same language as that of the village participants. In the event that the facilitator is not able to speak the same language as the participants, he/she would have to communicate the instructions through a translator.

Translator – Translators may be used in GMB workshops where there are language differences between the facilitation team and the community members. Translators thus help to provide simultaneous translation between the local language of the community and the language of the facilitation team.

Modeler – This person is drawing model structure in the form of notes as the activity goes on. He/she is thinking about questions to ask participants to get them to clarify stories, expand dynamics, and dive deeper on variables they contribute.

Note Taker – The note taker takes notes on specific stories, examples, and narratives that participants share in the workshop. They are not responsible for transcribing the whole session, but rather capturing the rich stories people tell, the logic they use, and anecdotes they share to help inform interpretation of models later on.

Photographer – The photographer takes photos of the sessions while in progress and takes photos of the “artifacts”, or products of the session at the end. They should be discrete and respectful, and should try not to use flash – no one likes having a camera in their face all the time!

Debriefer - The debriefer’s primary responsibility is to facilitate the discussion after a group model building session. This is a rotating role among the facilitation team. The debriefer follows a semi-structured format asking for people’s initial reactions, identifying areas of strength, and identifying areas of improvement for subsequent sessions. The debriefer should not be someone who experienced a particularly challenging situation during the group model building.

Note: One person can perform multiple roles – for instance, the roles of taking notes and photographs could be performed by the same person. Similarly roles of convener and facilitator might be performed by the same person. Facilitator and note-taker with prior experience in modeling can be helpful. A two to three member team with clear division of roles and responsibilities can help in effective facilitation of the sessions. An important point to remember is that the same team should conduct all the sessions to ensure continuity of the discussions.

3.2 GMB Preparation

Facilitation Team

- **Process:** Prior to field work, the facilitation team should gather to determine roles of each of the facilitation team members and review activities in the facilitation manual. Translation and appropriateness of prompts to be made during the activities should be clearly discussed and agreed upon by the facilitation team members. The place where GMB sessions will be held and other relevant logistics should be determined beforehand.
- **Village Context:** The facilitation team should review background information about the village beforehand. Having a fair understanding of the village context could be helpful in locating the discussions and using appropriate prompts during the sessions.
- **Participants:** The facilitation team should consider who to invite to participate in the GMB sessions. Participants may be a mix of males and females, include knowledgeable elders who can speak about the village's history as well as young people. The participants' level of engagement during the first two sessions could help inform who should be encouraged to attend the smaller group GMB workshop in Session 3.



3.3 Session 1: Resource Elicitation

Objectives:

Identify key social, economic, and ecological resources in the village, and understand how the community prioritizes them

Required Materials:

- Print out of resource variable drawings
- Thicker paper (for additional resources)
- Beans / multicolor coins
- Chart paper (to record votes)

TIP!

Laminate the print-out of resource variable drawings for repeated use.

Facilitation Steps:

1. **Setting up and introduction to the objectives:** The facilitation team should arrive in advance to invite the local community members and make necessary preparation in terms of finding an appropriate location for the workshop, identify where to post materials, and determine where participants and facilitation team should sit. The workshop should be preferably encouraged in the common meeting place of the village where all the community members can participate. The sitting arrangements should be organized in a circular or semi-circular fashion, providing space to lay out the cards with resources in the center.

As people gather, the convener should welcome everyone and introduce the facilitation team. He / she should highlight the role that everyone will play, and take the community's verbal consent for their participation. The facilitator should then introduce the overall objective of SEAL and the purpose for conducting these group model building workshops, which are:

- To understand how the community influences natural systems (like land, forests, water) and how those natural systems influence the community
- Help improve the work related to improving resilience of ecosystems and rural livelihoods.

Once the larger purpose of SEAL is clear, the facilitator should clearly state the agenda for the meeting for the day, i.e. to:

- Learn about the village livelihoods
- Explore important social, ecological, and economic resources in the village



Figure 2: Drawings of resource variables



Community members voting for the resources in Udaipur, Rajasthan

2. **Resource Elicitation:** After setting the tone for the meeting, the facilitator should begin the discussion by asking participants about the livelihoods people rely on in the village. Once the participants start sharing about the livelihoods they rely on the facilitator should then ask participants to think about the most important resources in the community, including the resources their livelihoods depend on, using the prompt:

PROMPT: “What are the key resources that support your village communities?”

The prompt could also be phrased more generally as what are the “things” or “assets” this village relies on. The facilitator should avoid asking what the village needs. As the participants discuss and name resources, the modeler can lay out pictures of the resources (if they are already drawn) on the mat / floor. The facilitator should encourage new resources rather than solely rely on resources that are already drawn. The modeler can write or draw pictures on pieces of paper as new resources come up in discussion and lay them out on the mat. Participants can also draw resources. As resources are named, the facilitator should encourage participants to specify what the picture signifies. For example, if a participant suggests ‘water’ the facilitator should ask what kind of water – surface water, ground water, water in streams, drinking water etc.

Once many resources have been named and participation slows, the modeler should review the resources on the mat / floor describing them as natural, economic, or social resources. The modeler can suggest probing questions to the facilitator to elicit additional resources.

3. **Resource Prioritization:** After all the resources are there, the Facilitator should ask participants to take seeds / plastic coins (or anything small that is locally available) and vote for the most important resource to the wellbeing of the village. Coins could be color coded with different colors for men, women, and children. Each participant gets three coins, and should be prompted to vote for their favorite. The facilitator should encourage participants to vote all at once, rather than watching each other vote in sequence (to avoid group think).

After the voting is done, the facilitator should review and write down on chart paper which resources received the most votes. The facilitator should then ask participants why they prioritized the resources in this way and lead a short discussion.

4. **Next Steps and Closing:** Following the discussion, the facilitator should end the session by thanking the participants and explaining that the team will return and what the next activity will focus on. The note taker / photographer should make sure that photos of all the resources and votes are taken.
5. **De-briefing of the facilitation team:** After the field visit, the facilitation team should discuss how the facilitation process went. In preparation for session 2, the prioritized list of resources should be reviewed and 5-7 resources should be selected for the trends over time activity. Resources should be from the list of the top prioritized and reflect a diversity of social, economic, and ecological resources.

Output checklist:

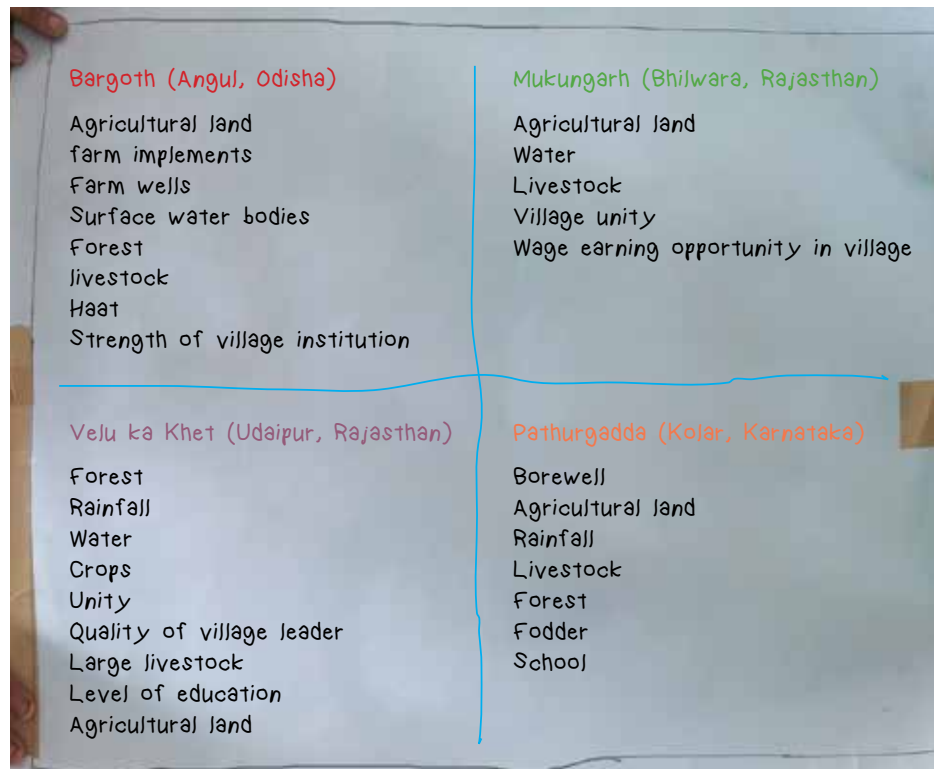
- List of all the resources elicited
- Votes of participants for different resources

TIP!

Encourage all participants in the session to contribute at least one resource variable, or to share their interpretations of the resources that are drawn. This helps to improve the participation of all who are present, thereby adding to the diversity of views.

FYI

Resources may be both tangible things (e.g. water, soil, livestock etc.) or intangible (e.g. crop quality, strength of village governance etc.). Prompt participants to think of intangible resources or assets if there are none or few listed.



List of all resources elicited in each location

3.4 Session 2: Trends over time

Objective:

Understand how key resources have changed over time and communities' hopes and fears for the future

Required Materials:

- Chart paper (for time lines)
- List of prioritized resources (from the previous session)
- Print out of resource variable drawings
- Beans / multicolor coins
- Thick tip markers (multiple colors)

Facilitation Steps:

- 1. Setting up and introduction to the objectives:** The facilitation team should arrive in advance to invite the local community members and make necessary preparations in terms of finding an appropriate location for the workshop, identify where to post materials, and determine where participants and facilitation team should sit. The facilitation team should draw table for the trends over time activity given on right:

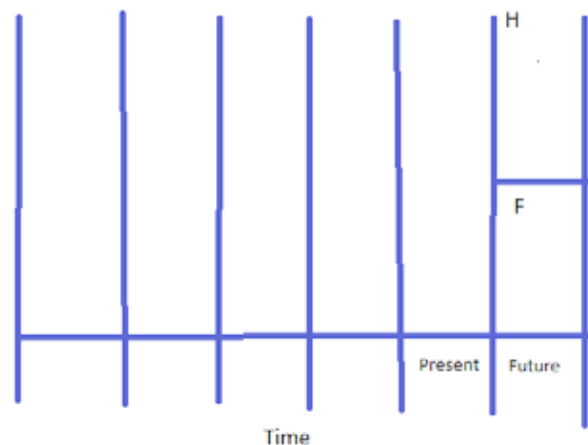


Figure 3: Table for trends over time activity

There should be 5-7 blank tables for the activity with at least 6 time points, including present and future. As people gather, the facilitator should welcome everyone and do a quick recap of the previous session, thereafter stating the agenda for the meeting, i.e.:

- Understand how the key resources that were discussed in the previous session have changed over time
 - Explore community's hopes and fears for the future
- 2. Trends over time:** Once the agenda for the meeting is clear, the facilitator should begin by explaining that while in the previous session they were interested in exploring which resources were important to the village, in this session they would like to understand how those resources have changed over time. The facilitator should then pull out a list of prioritized resources written on a piece of chart paper and their corresponding simple picture. He / she will read out the resource name, and ask participants who were in the meeting on the previous day to briefly explain the role of the resource in the village.

Referring to the table drawn on the chart paper, the facilitator should begin by asking

“What are the important events in the life of this village?”

The discussion will yield 3 or so important events, which will be written with a description and an estimated year on the table. The second to last column will include today, or present year. The final column will refer to 10 years in the future, or something like “When the small children have grown”. This column will be divided in half to capture hopes and fears for the future.



Community members showing the trend over time of forest condition in Angul, Orissa

The facilitator should then select 5-7 resources from the prioritized list, one resource per blank table. The participants could then be divided into two groups, one facilitator with each group. The resources for which behavior over time graphs need to be prepared could be divided between the two groups. (However, if there aren't enough participants or facilitators to split into two groups, then the activity can be done in only one group with 3-5 resources).

The facilitator should explain to the group that they are interested in understanding how these resources have changed over time. He / she should bring out a set of beans, plastic coins, or stones (if beans or coins are not available), and indicate that for each year we have a maximum of 10 beans available. We want to see how much of each resource existed at each year. The facilitator should then demonstrate that for example if they think that in 1990 there was abundant forest, they put 9 of the 10 beans in the 1990 column.

The facilitator should ask for a volunteer from the group to lead their group in placing the beans for each resource. The group will negotiate the relative number of coins per year, keeping a maximum of 10 per

column. When the group completes one resource table, optionally a new volunteer can lead the next discussion. After each column, the modeler should translate the points to a behavior over time graph, on which the dates have been placed on the bottom. At each point, the number of coins will correspond to a percentage on the graph (4 beans ~40%). Converting the table to a behavior over time graph can happen either during or after the exercise. At the completion of the exercise, the table will look something like this:

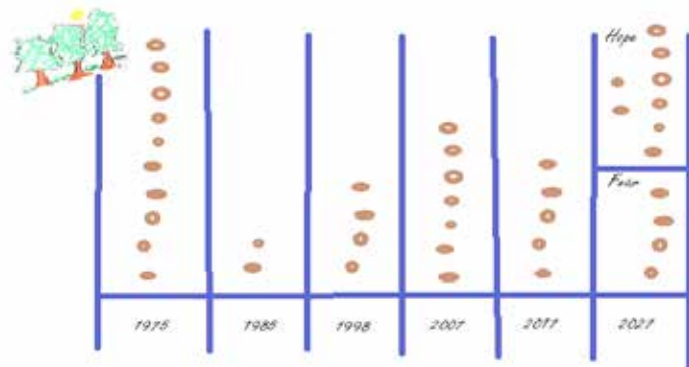


Figure 4: Table developed from a trend over time activity

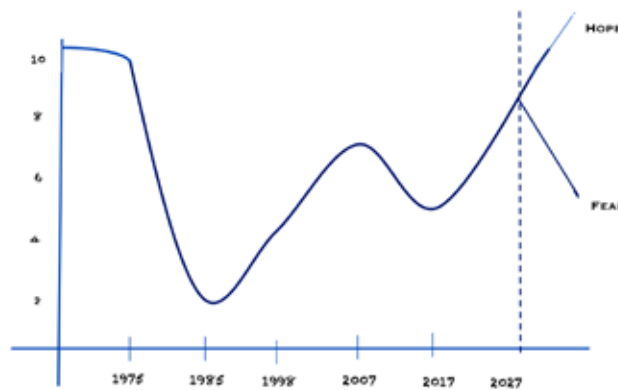


Figure 5: Trend over time graph developed from the table

3. **Trend review:** Once the behavior over time graphs have been drawn for all the resources, the modeler should present the completed graphs (or table if the modeler was unable to draw graphs during the exercise) one by one to the group. He / she should trace with a finger, a stick, or a marker the trend over time, reflecting back the story (as shared by the participants during the exercise) of how resource changed over points in time. Alternatively, the modeler could also recruit a volunteer to tell the story of the graph. The modeler should ask the participants whether he/she reflected the story correctly – particularly when there is a large gap in time, or to test whether the future trend is realistic or not.
4. **Next Steps and Closing:** The facilitator should then end the session by thanking the participants for their time and sharing about what the next session will focus on. He / she should identify which participants would like to join session 3 for an in depth discussion of how resources are connected. The selected small group should be no larger than 10. The facilitator should also ask the participants to suggest a place where the next session should be held. The place for the next session should preferably be outside the village and in a closed place (such as a meeting hall) so that the participants can have a focused discussion.
5. **De-briefing of the facilitation team:** After the field visit, the facilitation team should discuss how the facilitation process went. The trend lines created using beans should be drawn as graphs on chart paper with markers (if not already done). The team should review the trends over time graphs and discuss which resources should form the basis for the next session's activity. A relevant example to explain polarity of causal relationships should be decided.

Output checklist:

- Behavior over time graphs

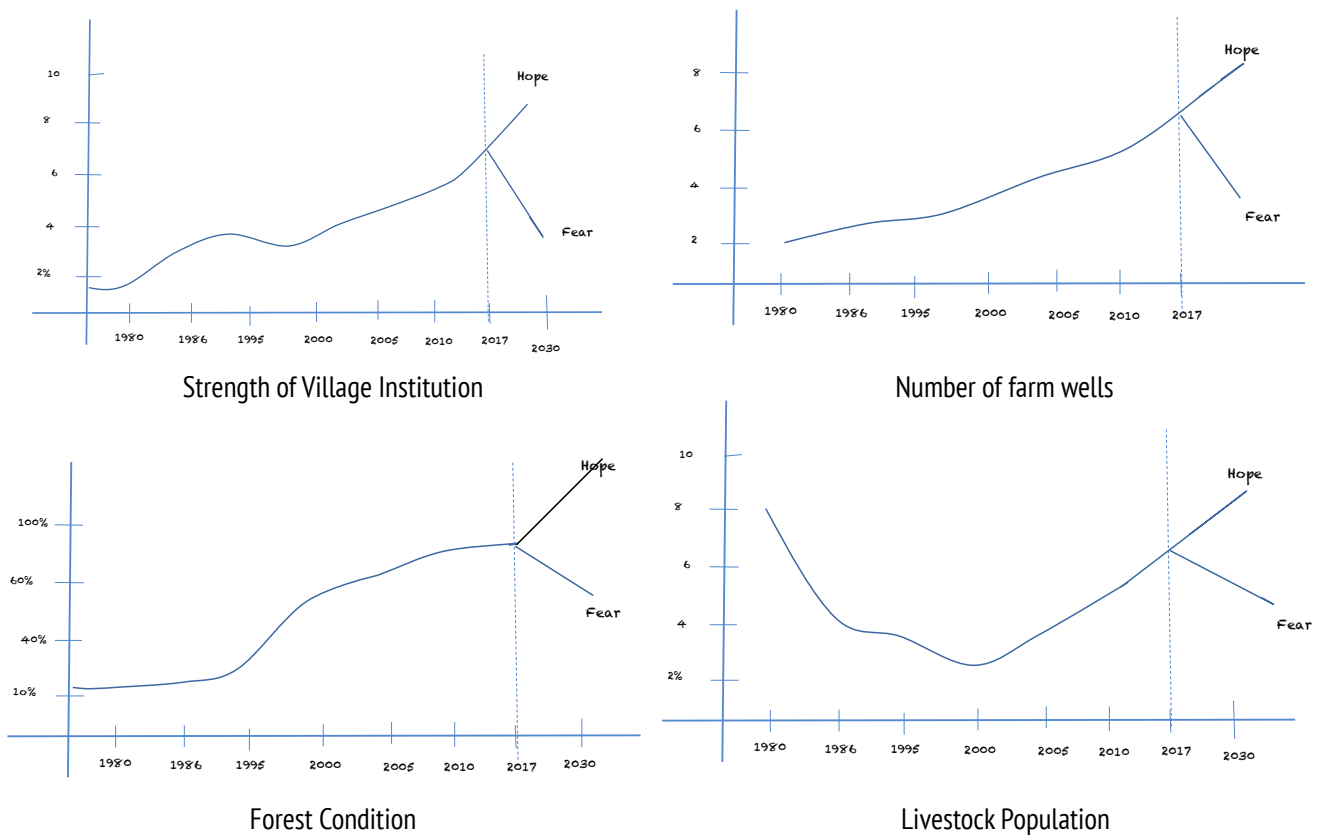


Figure 6: Behavior over time graphs - Angul, Orissa

3.5 Session 3: Causal Loop Diagrams (CLDs)

Objective:

Identify how key resources are interconnected

Required Materials:

- Chart paper
- Thick tip markers (multiple colors)
- Tape
- Print out of resource variable drawings
- Thicker paper (for resources or variables)
- Behavior over time graphs (from the previous session)

Facilitation Steps:

1. **Setting up and introduction to the objectives:** The facilitation team should arrive in advance to invite the local community members and make necessary preparations. Four sheets of chart paper should be taped together to create one large chart. As the participants arrive, the facilitator should state the agenda for the meeting i.e.:
 - To learn about how key resources in the village are connected
2. **Causal Loop Diagram:** Once the agenda for the meeting is clear, the facilitator should explain that the goal of this session is to look at how resources are connected to each other. He / she should bring out the same resources from the prior sessions, including drawings and additional written resources, and lay them out on the ground. Also lay out the trends over time graphs. Then, the facilitator should ask a volunteer to explain what has come before in this process.

The facilitator should then lay out four pieces of chart paper, taped together to make one large chart and arrange the resources around the paper in the center of the group. The facilitator should demonstrate that they want to see how the resources are connected to each other by creating a link. The facilitator should draw an example on a separate sheet of paper to explain how connections can be drawn using an arrow and a plus or minus sign. Such as:

Note: A plus sign indicates that the two variables have a positive causal relationship, which means when one increases, the other increases and vice versa. Conversely, a minus sign indicates a negative causal relationship between the variables, which means that as one increases, the other decreases, and vice versa.

The facilitator should then select 2-3 resources (decided in the debrief session) with clear connections to begin with and prompt the participants to:

Think of how these resources are connected. Suggest a connection and then explain the connection to the group.

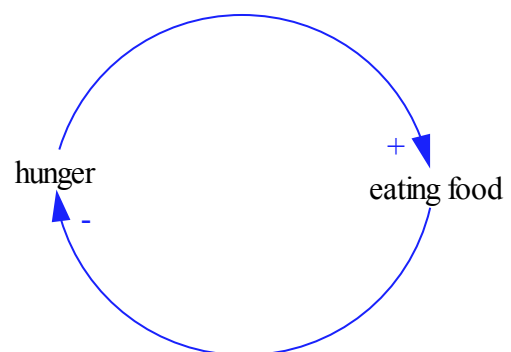


Figure 7: Example of a causal loop diagram



Facilitator asking the community about the correlation between forest and fodder in Udaipur, Rajasthan

The facilitator should allow the group to negotiate whether the connection exists and then ask whether it needs a plus or minus sign, signifying directions with their thumbs. After the initial connections are drawn, the facilitator should ask participants to consider the other resources and how they might be connected. The facilitator should prompt participants to continue to specify what each drawing means (for example: does this drawing represent soil health, yield, etc). The facilitator should also remind participants we are discussing causal connections, not physical proximity.

After about an hour or so, as participation begins to slow, the facilitator should suggest a brief break. During the break, the facilitation team should review the CLD so far and consider whether social, ecological, and economic resources are all represented. The team should look for feedback loops and where connections may be missing. The team should then discuss and decide on some additional questions to probe, especially from the SEAL perspective.

After the break, the facilitator should probe the participants with additional questions and ask them to continue adding resources and connections as they think reflects what is happening in their village. When

the activity is finished the causal loop diagram may look something like this:

The facilitator could ask for a volunteer from the group to tell the stories of the links to the entire group.

3. **Next Steps and Closing:** The facilitator should then end the session, thanking the participants and explaining when the team will return and what the next activity will focus on.
4. **De-briefing of the facilitation team:** After the field visit, the facilitation team should discuss how the facilitation process went. The facilitation team should refine the CLD. The goal is to simplify and make feedback loops more explicit. The CLD should be redrawn using the same pictures of resources and a new sheet of chart paper (4 sheets taped together). If appropriate, a few key feedback loops using crayon or a different color marker could be highlighted.

Output checklist:

- Causal loop diagram (photograph)

TIP!

If participants are not able to form a direct causal link between the resource variables that have been drawn, ask them to think of other resource variables that are not on the chart, and to draw on a blank sheet of paper to represent the new variable.

3.6 Session 4: Causal Loop Diagrams Refinement

Objective:

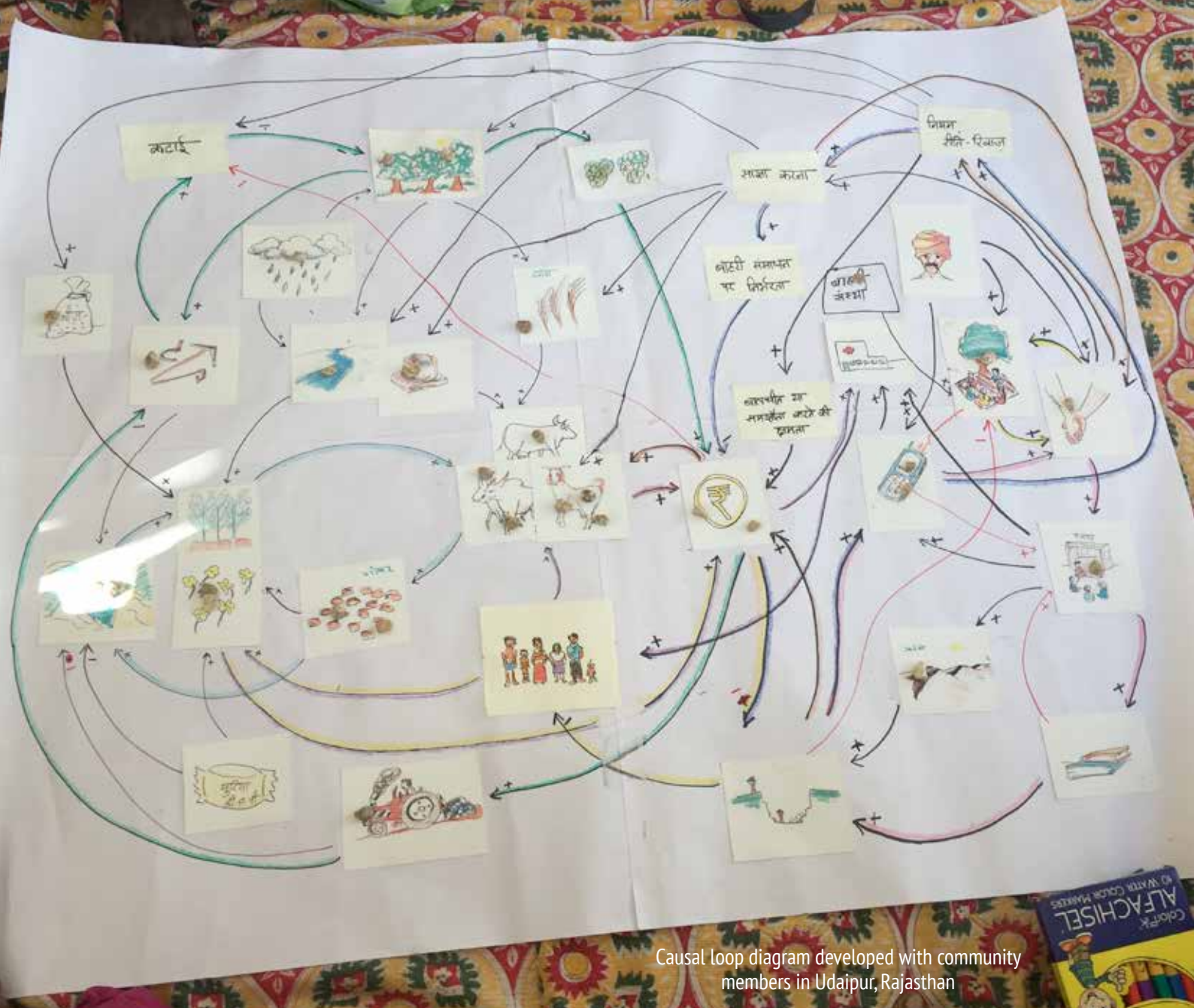
Refine the connections between key resources and variables

Required Materials:

- CLD from session 3
- Chart paper
- Thick tip markers (multiple colors)
- Crayons (multiple colors)
- Tape
- Print out of resource variable drawings
- Thicker paper (for resources)

Facilitation Steps:

1. **Setting up and introduction to the objectives:** The facilitation team should arrive in advance to invite the local community members and make necessary preparations in terms of finding an appropriate location for the workshop, identify where to lay out the CLD, and determine where participants and facilitation team should sit. As the participants arrive, the facilitator should state the agenda of the meeting, i.e. to:
 - Validate and refine the CLD that was created with a small group of participants
2. **Model presentation:** The facilitator should roll out the causal loop diagram on the floor/on the wall of the meeting space. He / she should explain that based on the CLD created with a small group and the rich stories from the previous sessions, the team has tried to capture all of this in a refined CLD. The facilitator should begin by telling a set of stories of the CLD as feedback loops – describing the dynamics of exponential growth and goal seeking behavior. He/she should explain that these feedback loops help explain the behavior over time graphs from session 2, referring to the graphs if possible.
3. **Refining the CLD:** The facilitator should ask the group whether the stories narrated by them have been captured accurately. He / she should then explain that there are some pieces that they didn't fully understand in the map and want clarification. If a participant speaks up with a clarification, the facilitator should hand them a marker and ask them to describe how to update or make a change. The facilitator should probe additional questions related to SEAL. For example:
 - How do social resources (like village strength) influence economic resources (like markets or local exchange, agriculture and livestock)?
 - How do social resources (like village strength) influence natural resources (like water, forests)?
 - Where do social resources come from?
 - How does the village respond to conflict, crisis situations or shocks?



Causal loop diagram developed with community members in Udaipur, Rajasthan

- How do you think the village will change as education, better connectivity to markets, and outside work opportunities arise?
 - How will it change your interaction with other resources (agriculture/forests)?
 - How will it change your social resources (village strength, unity etc)?

4. **Next steps and closing:** The facilitator should then end the session and review how activities are connected and how they are related to SEAL. He/she should then thank participants and say that the refined models will be brought back to the community in the future.

Output Checklist:

- Refined CLD (with changes made by the participants highlighted in a different colour)

3.7 Session 5: Causal Loop Diagram Validation

Objective:

Revisit the connections between key resources and variables with a focus on validating narratives and revising or closing feedback loops

Required Materials:

- CLD from session 4
- Chart paper
- Thick tip markers (multiple colors)
- Crayons (multiple colors)
- Tape
- Print out of resource variable drawings
- Thicker paper (for resources)
- Behavior over time graphs

Before the meeting: This meeting should be held after a couple of months. If necessary the CLD (including changes from Session 4) should be redrawn on chart paper. The facilitation team should review the feedback loops and use different colors to highlight different loops. Notes from previous sessions should be reviewed and discussed with respect to whether the feedback loops accurately represent the narratives told by the community. If the narratives are not accurately represented, then the facilitation team should make a note of the points to be discussed with the community at the meeting. A note should be made of which connections were added by the facilitation team. Probing questions related to SEAL, connections added by facilitation team, and any missing or confusing feedback loops should be noted down.

Facilitation Steps:

1. **Setting up and introduction to the objectives:** The facilitation team should arrive in advance to invite the local community members and make necessary preparations in terms of finding an appropriate location for the workshop, identify where to lay out the CLD and behavior over time graphs, and determine where participants and facilitation team should sit. As the participants arrive, the facilitator should state the agenda of the meeting, i.e. to:
 - Validate and refine the CLD that was created with a small group of participants
 - Review key feedback loops and add additional connections to close loops
2. **Model presentation:** The facilitator should roll out the causal loop diagram on the floor/on the wall of the meeting space. He/she should review the resources and what the pictures represent. The facilitator should then explain that the CLD represents connections drawn in the last session and additional connections from the rich stories from the previous sessions. The facilitator should again underscore that the arrows represent causal connections (not physical proximity) and review polarity. He/she should then describe how the connections drive the behavior over time drawn in the behavior over time graphs (Refer to the behavior over time graphs from Session 2).



Facilitator validating the causal loop diagram with community members in Chittoor, Andhra Pradesh

3. **CLD validation and feedback refinement:** The facilitator should begin by telling a set of stories of the CLD as feedback loops. He/she should choose a simple feedback loop to begin and ask the group whether we have captured the stories accurately. If the stories are not captured, links should be added / removed or polarity should be changed as needed using a different color marker. If a participant speaks up with a clarification, the facilitator should hand them a marker and ask them to describe how to update or make a change. The facilitator should continue telling the story of each feedback loop, making changes or additions as necessary. If any connections were made by the facilitation team, these connections should be highlighted and the facilitator should ask if the community agrees. Changes based on the responses and discussion with the participants should be made. The facilitator should ask probing questions such as:
- Are there any connections that might exist to close feedback loops?
 - How does the health of ecological resources influence economic resources?

- How do economic resources influence social resources?
- How do social resources (like village strength) influence economic resources (like markets or local exchange, income and expenses, agriculture and livestock)?
- How do social resources (like village strength) influence natural resources (like water, forests)?
- How does the village respond to stress, conflict, crisis situations or shocks?
- How do you think the village will change as education, better connectivity to markets, and outside work opportunities arise?
 - How will it change your interaction with other resources (agriculture/forests)?
 - How does this influence your income and expenses?
 - How will it change your social resources (village strength, unity etc)?

In summary, the facilitator should briefly review the feedback loops and new changes. He / she should ask participants what are the different development programs in their village? Where do they see them happening in this CLD? Connection to the specific resource or variable the program is influencing should be drawn.

4. **Next steps and closing:** The facilitator should then end the session and review how activities are connected and how they are related to SEAL. He/she should thank participants and say refined models will be brought back to the community in the future.

Output Checklist:

- Refined CLD (with changes made by the participants highlighted in a different colour)

Appendix 1: Glossary of terms

Term	Definition
Boundary object	A tangible representation (e.g. diagram with few words) to illustrate key concepts, actions and the relationships between them, which are accessible and modifiable by all participants (Black & Andersen, 2012).
Causal loop diagram	An informal model or causal map representing a theory of the causal relationships between variables in a system, and includes feedback effects of the variables.
Community based system dynamics	A participatory method for involving communities in the process of understanding and changing systems from the endogenous or feedback perspective of system dynamics (Hovmand, 2014).
Feedback loop	A closed loop structure that brings results from past action of the system back to control future action (Forrester, 1990).
Group model building (GMB)	A process of involving multiple stakeholders that are central to a project in developing an informal or formal model, and thereby creating shared insights, consensus, and motivation for implementing the results (Hovmand, 2014)
Mental model	A mental model is a relatively enduring and accessible, but limited, internal conceptual representation of an external system (Doyle & Ford, 1998).
System	A set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviors (Meadows, 2008).
System dynamics	System dynamics (SD) is a method for understanding, designing, and managing change. It models the relationships between elements in a system and how these relationships influence the behavior of the system over time.
Participatory rural appraisal	It refers to a set of participatory methods that are meant to engage communities and allow them to take the lead in expressing, analyzing and finding the solutions for their problems or undesirable conditions.

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