A Handbook for Participatory Action Research, Planning and Evaluation

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Module 6

Understanding Systems
Purpose
To describe how people view a domain or topic area, and create new learning opportunities based on this understanding.

PRINCIPLES
The theory of human understanding underlying Domain Analysis is a social adaptation of Personal Construct Psychology, a well-known theory in Psychology and the Cognitive Sciences developed in the 1950s by George Kelly. The key assumption is that people understand a domain by dividing it into parts and creating a description of the whole based on comparisons (or degrees of similarity and difference) between the parts. For example, to know the meaning of ‘tasty food’ requires not only a sense of what ‘tasty foods’ have in common but also words and ideas to describe the opposite. In Personal Construct Psychology, domain parts are called elements and the contrasting characteristics are called constructs. The social adaptation presented below builds on this perspective by showing how stakeholder groups create and organize elements and their contrasting characteristics for a domain or topic area. The method uncovers ways people make sense of reality in a particular context and helps create opportunities for problem solving and learning.

Domain Analysis can be applied to any topic including things in nature (Ecological Domain), activities (Activity Domain), problems (Problem Domain), stakeholder profiles (Social Domain), and options for action (Option Domain). Following are detailed instructions for the tool, which can be adapted for these specific applications (see examples below). Information gathering and analysis can be done manually, as described below, or using the software RepGrid (http://regrid.com).

Step 1
Define the domain or topic area and identify at least six elements and no more than 12 that belong to the domain. These should be concrete, distinct and clearly defined. If the elements are vague, use the Laddering Down method in Active Listening to make them more specific and meaningful. Ask ‘What do you mean by this?’ or ‘Can you give an example of this?’. Another option is to use description and storytelling to explore the topic, and then use this information to identify the elements. Write or draw each element on its own card with a brief description on the back of the card.

Step 2
Decide on a rating scale with a range from 1-5 or 1-7 (see Scoring Tips). Create a table on the floor or wall with the term ‘Characteristics’ at the top of Column 1.

Step 3
If necessary, discuss or provide one key characteristic participants want to explain in light of a problem-solving exploration of the domain. Write the key characteristic on a card, using one or two key words and give it a score of 1. Then, identify the opposite of the key characteristic on the same card and give it a score of 5 (or 7). Place the card showing these two opposite characteristics and the corresponding scores in the second row of the first column. (This step and the next two steps are optional.)

Step 4
Rate all the elements using the key characteristic and its opposite and the rating scale (from 1 to 5, for instance). Discuss the score for each element until participants agree. Record each score on its own card and write the reason given for each score on the reverse side of its card or on a flip chart. Place each score card in the row for the key characteristic, below the corresponding element.
Domain Analysis

Step 5  To facilitate interpretation of the table, **reorganize** all the elements in order based on the ratings given for the key characteristic.

Step 6  To elicit other characteristics from participants, choose **three** element cards from the top row at random. Identify two of them (a pair) that are the same in some important way, and different from the third. Identify what it is these two elements have in common that is also **relevant to the topic**. Write the characteristic on a new card and give it a score of 1. Then, identify the opposition or contrast that makes the **third element different from the pair**. Write this opposite or contrasting characteristic on the same card and give it a score of 5 (or 7). Examples of opposite characteristics are: a good leader – an ineffective leader; reliable – unreliable; safe - risky; etc. Place the card showing these two opposite or contrasting characteristics and the corresponding scores in the third row of the first column.

Step 7  Repeat the process described in Step 6 to identify **other sets of opposite or contrasting characteristics** and add a **new row** for each set.

Step 8  **Rate all the elements** using each characteristic and its opposite and the rating scale created in Step 2. Discuss the score for each element until participants agree. Record each score on its own card and write the reason given for each score on the reverse side of its card or on a flip chart. Place each score card in its row, below the corresponding element.

**INTERPRETING THE RESULTS**

Step 9  To **interpret** the results, start with a **review of the process**, including the way that participants interacted and reached decisions at each step. Also review the **substance** of the exercise, including the topic that participants selected, the elements and the characteristics identified, and the kind of information or knowledge used to rate the elements. Summarize the main points on a flip chart.

Step 10  Review the **column scores** that describe the elements. Look for obvious features such as whether the scores tend to be in the middle or closer to the poles. Also look for the elements that have **similar scores** for most characteristics, including the key characteristic. Summarize the characteristics they share and draw lines connecting elements with similar column scores to show that they are part of the same **cluster** or family of elements.

Step 11  Review the **row scores** that describe the characteristics. Look for obvious features such as scores that vary little and others a lot, or characteristics that are more meaningful compared to others. Also look for **matching characteristics**. There is a match between two or more characteristics when row scores are **similar** or show an **inverse relationship** to each other. Summarize the matches and draw lines connecting characteristics with similar (or inverse) row scores. Characteristics that match the **key characteristic** (identified in Step 3) can help explain important aspects of the topic area.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conflict A</th>
<th>Conflict B</th>
<th>Conflict C</th>
<th>Conflict D</th>
<th>Conflict E</th>
<th>Conflict F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rarely (1)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Often (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal (1)</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Personal (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interests (1)</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Values (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rethinking the Analysis

Step 12 Modify, delete or add to the list of elements, characteristics, and scores at any time during the process.

Look for an extra characteristic and opposite if two elements that are very similar need to be distinguished from each other more sharply. To do this, find a meaningful difference between the two elements. Use this difference to create a new characteristic and its opposite and rate all the elements on this characteristic.

Look for an extra element if two characteristics that are closely matched need to be distinguished from each other more sharply. To do this, find a new element within the domain that brings together the characteristics that are rarely matched. Insert the new element in a new column and rate it for each characteristic and its opposite.

Step 13 Review and summarize key comments concerning the domain or topic made during the exercise. Then identify the learning opportunity (see Learning Opportunities, below) and develop a strategy to act on this understanding.

Be sure to review in detail the Scoring Tips. These are critical to proper application of Domain Analysis.

Tips on Elements

- **Supply** or **negotiate** some or all the elements or **elicit** them from the participants, depending on the purpose of the exercise and the facilitator’s role.
- The list of elements can include an ideal or a problematic element that can be compared with other elements.

Tips on Characteristics (Constructs)

- **Supply** or **negotiate** any characteristic and its opposite or **elicit** them from the participants, depending on the purpose of the exercise and the facilitator’s role.
- When using characteristics to describe the elements, do not interpret the descriptions as statements of facts that are either right or wrong. Statements about elements should be **accurate** only in the sense of truly reflecting people’s views and understanding of reality.
- Characteristics should be **relevant** to the topic area, **focused** and **clear**. They should usually consist of **concrete** nouns, actions or verbs ending in ‘-ing’ rather than abstract terms, qualities or ideas.
- Characteristics and their opposites can include responses or concrete actions related to each element (see Problem Domain).
TIPS ON CHARACTERISTICS (CONSTRUCTS) continued

- If the characteristics are vague or sound like clichés, use the Laddering Down technique in Active Listening to make them more meaningful and detailed. Ask “What do we mean by this?”, “Can we give an example of this?”, “How can we tell this?”, or “In what way is this true?”.

- Don’t use negative phrases, such as ‘not legal’ to describe the opposite of or contrast with a characteristic such as ‘legal.’ Negative phrases tend to be vague and meaningless. Opposites or contrasts phrased more precisely will describe people’s views on a domain in a more meaningful way.

- If necessary, some of the characteristics may involve a single pole or reference point against which all the elements are rated. For example, ‘cost’, ‘importance’, ‘priority’, ‘feasibility’ may go from low to high (see Option Domain).

- If participants cannot identify what it is that two elements have in common or what makes the third element different from the pair, ask in another way, apply the Laddering Down technique (see Active Listening), choose another three elements at random or choose two cards instead of three.

- You can use other elicitation tools to identify characteristics and their opposites, without comparing elements chosen at random. A simple procedure is the catchall question: ‘Can you think of some new, different characteristic and its opposite?’ Another option is the full context procedure: review all elements and find two that have a characteristic in common, and then the element that is the most different from these and in what way. Use this procedure to identify one or more characteristic and its opposite. Another option is to use description and storytelling to explore the topic (for example, by describing examples of success and failure), and then use this information to identify the elements as well as their characteristics organized into opposites.

- To identify several characteristics and their opposites in less time, divide all participants into groups of two or three. Ask each group to choose three elements at random and to identify a relevant characteristic and its opposite. Collect these new characteristics and their opposites, discuss and clarify their meaning, and group together those that are the same (see tips in Social Domain).

- Don’t use a characteristic together with its opposite more than once. However, a particular characteristic can be used more than once if it is paired with a different opposite characteristic (such as ‘legal’ as opposed to ‘personal’ in one case, and then ‘legal’ as opposed to ‘political’ in the other case).

- Characteristics can be grouped together into appropriate categories supplied by the facilitator or created and defined by the participants (see Free List and Pile Sort). They can also be ranked by order of importance. This will help with interpretation of the table at the end of the exercise.

TIPS ON RATING

- If the characteristic and its opposite do not apply to an element, don’t provide a score. If a characteristic does not apply to many elements, try rewording it or leave it out of the analysis.

- If the scores for a characteristic and its opposite are nearly the same across all elements, redefine the characteristic or leave it out of the analysis.
TIPS ON RATING continued

☐ The rating of elements can be done without focusing attention on the table. To do so, place a card representing a characteristic and some distance apart another card representing its opposite or contrast. Then take each element card or an object representing the element and ask participants to locate the element somewhere on the continuum between the two characteristic cards. Convert this location into a rating, and track the scores separately in a table or directly in RepGrid. Repeat this exercise for each characteristic and its opposite.

TIPS ON INTERPRETING

☐ When comparing elements, focus on those row characteristics and relationships that are more important or interesting. Don’t assume that all relationships are meaningful. This would be over-interpreting the results.

☐ As noted in Step 5, use the ratings for the key characteristic (identified in Step 3) to reorganize all element cards (row 1) and score cards (row 2) from the lowest score to the highest. The reorganized table will help explain the key characteristic.

☐ Group together similar elements by moving the columns around and placing them side by side (use masking tape to stick the column cards together). Do the same with matching characteristics, by moving the rows around and placing them one above the other.

☐ Where you find high matches between row scores or sets of characteristics and their opposites, discuss whether one row set is an example or the effect of the other row set, or if it has the same meaning or the same cause as the other set.

☐ To focus on two characteristics and their opposites only, create a diagram by drawing a vertical line that crosses a horizontal line of equal length. If your scale is from 1 to 5, write 1 and 5 at opposite ends of both the horizontal line and the vertical line; indicate what these minimum and maximum scores mean. Write 3 where the two lines cross. For each element, locate the score for one characteristic and its opposite on the horizontal line, and then the score for the other characteristic and its opposite on the vertical line. Connect the scores from the two lines, and write the name of the element where they meet. The closer two elements are in the diagram, the more similar they are.
TIPS ON INTERPRETING continued

- To help people participate actively in the analysis, prepare and distribute copies of the element cards among the participants. Then ask participants to identify other elements with row scores that are identical or very similar to theirs. Give special attention to similarities in the key characteristic and other characteristics important to the domain. Groups formed around similar elements can then prepare and present a brief description of what the elements have in common. Following this, all participants can discuss the main differences observed between groups (see tips in Social Domain).

TIPS ON THE MATHEMATICS

- The software RepGrid (http://repgrid.com/) performs the calculations described below. The Focus command creates a cluster analysis. Elements that have the most similar ratings are placed side by side. Characteristics that are closely matched also appear side by side, with inverse relationships converted into positive relationships. A diagram with lines outside the table meeting at various points indicates the levels of similarity between elements and between characteristics.

- The PrinGrid command creates a graph with calculations based on principal component analysis. The graph is a two dimensional representation of multidimensional relationships among elements and characteristics. Dots show the location of each element in relation to all other elements and to characteristics represented by straight lines. The shorter the characteristic line, the less the ratings for the characteristic vary. Closer relationships between elements (dots), between characteristics (lines), and between elements and characteristics are shown by their distance from each other. The main horizontal line (principal component 1) and vertical line (principal component 2) are summary variables for these multidimensional relationships. The percentages at the end of each line indicate the extent to which each component explains these multidimensional relationships. (See examples.)
TIPS ON THE MATHEMATICS continued

- To manually calculate the level of difference between two column elements, calculate the sum of differences (SD) between same-row scores (leave out rows that have empty squares). Then calculate the total maximum difference for all scores (this is MS, the maximum score, minus 1, multiplied by C, the number of row characteristics that got ratings). The level of difference between two elements is SD divided by the total maximum difference for all scores multiplied by 100. To turn this level of difference into a percentage similarity score, subtract it from 100. In other words: \[100 - (SD \times 100)\] / \[(MS-1) \times C\]. Using the table created in Step 7 as an example, the sum of differences (SD) between the recorded scores for elements E and F is 2 and the total maximum difference is 12, or \[(5 - 1) \times 3\]. This results in a difference of 16.7% (2/12 x 100). Looking at it another way, the two elements are similar at a level of 83.3%.

- To manually calculate the level of difference between two row characteristics, calculate the sum of differences (SD) between same-column scores (leave out columns that have empty squares). Then calculate the total maximum difference for all scores (this is MS, the maximum score, minus 1, multiplied by E, the number of elements that got ratings). The level of difference between two characteristics is SD divided by the total maximum difference for all scores multiplied by 100. To turn this level of difference into a percentage similarity score, subtract it from 100. In other words: \[100 - (SD \times 100)\] / \[(MS-1) \times E\]. Using the table created in Step 7 as an example, the sum of differences (SD) between the recorded scores for the last two rows is 14 and the total maximum difference is 24, or \[(5 - 1) \times 6\]. This results in a difference of 58.3% (14/24 x 100). Looking at it another way, the two elements are similar at a level of 41.7%.

- If the level of similarity between two sets of row scores is very low, this indicates an inverse relationship. This means that if participants choose a characteristic at one end of the continuum in one row then they tend to choose the characteristic at the opposite end in the other row. When this happens, turn the inverse relationship into a positive one by reversing all the scores in one row (from 2 to 4 or from 5 to 1, in a scale from 1 to 5, for instance). Positive relationships are easier to interpret. For instance, by reversing the scores for the last row in the table already presented, the level of similarity between the last two rows is 83.3%.
LEARNING OPPORTUNITIES

Domain Analysis helps to identify learning opportunities based on an understanding of multidimensional relationships among elements and characteristics within the domain or topic area. Opportunities may involve structural learning, communicational learning, temporal learning or adaptive learning. Understanding the nature of the learning opportunity helps with development of an action strategy.

STRUCTURAL LEARNING

Convergence
There is convergence in the system when the row scores in the table are closely matched. In this case, most characteristics can be regrouped into two categories that are opposite each other, with the elements falling somewhere along the continuum from one set of opposites to another. If convergence in the system is limiting, search for new elements that combine the characteristics in novel ways. Give special attention to novel ways of combining elements with the key characteristic identified in Step 3 (see example in Activity Domain).

Polarization
There is polarization in the system when one group of elements has one set of column scores and the other group of elements is opposite in all respects. In this case, most elements can be regrouped into two categories that are opposite each other. If polarization in the system is limiting, search for new elements that combine the characteristics in novel ways. Give special attention to novel ways of combining elements with the key characteristic identified in Step 3.

Dispersion
There is dispersion in the system when very few elements or characteristics are closely matched. This indicates that each element is entirely different and there is no pattern in the system. If dispersion in the system is limiting, search for other elements or characteristics that may be missing and needed to introduce some meaningful pattern into the system (see example in Social Domain).

Vagueness
There is vagueness in the system when the scores for the elements do not vary much. If this is limiting, search for the likely cause. Some possibilities are: participants have very different views of the elements and negotiated the differences by assigning average scores; participants emphasize the connections and similarities between the elements, not the differences; participants have limited knowledge of the domain or topic area; the elements chosen are too general.
COMMUNICATIONAL LEARNING

Disagreement

There is disagreement when people give very different scores to the same elements using the same characteristics. To measure levels of agreement and disagreement between two tables or sets of scores, total the differences between same-square scores and divide this number by the total maximum difference between all squares (this is MS, the maximum score, minus 1, multiplied by E, the number of elements that got ratings). If disagreement is a limitation, identify the key area(s) of disagreement and the likely causes. Continue discussion of the causes until the scores reflect a common assessment of the situation.

To compare many characteristics and tables representing the views of different individuals or groups, reorder the row characteristics in each table from top to bottom, with those at the top matching the ratings of the key characteristic identified in Step 3. These key matching characteristics represent what each individual or group has in mind when thinking about important aspects of the topic. Then, look for key matching characteristics that participants agree or disagree with across the sample. If the tables contain many characteristics, they can be grouped into categories (see Tips on characteristics), reordered from top to bottom within each category, and then assessed for key match agreements and disagreements across the sample within each category. The software RepGrid will also compare tables that contain some or all the same elements and characteristics. Levels of agreement may be combined with levels of understanding (below) to produce the six possible scenarios outlined in Disagreements and Misunderstandings.

Misunderstanding

There is misunderstanding when a party with a particular profile (such as men) fails to predict how a party with a different profile (such as women) will rate certain elements. To measure levels of misunderstanding, each party must try to guess how the other party will rate the same elements using the same characteristic(s). Then, total the differences between the original scores and the scores each group predicted for the other. Divide this number by the total maximum difference for all squares (this is the maximum score minus 1, multiplied by the number of elements). If misunderstanding is a limitation, identify the key area(s) and the likely causes of misunderstanding. Compare and discuss the scores until a better understanding of each other’s views is created. Levels of understanding may be combined with levels of agreement (above) to produce the six possible scenarios outlined in Disagreements and Misunderstandings.

Confusion

There is confusion among people when the parties use different elements or characteristics to describe the same domain or topic. If confusion is a limitation, search for common elements or shared characteristics to create some basis for mutual understanding and agreement.
TEMPORAL LEARNING

Instability

There is instability in the analysis when the way people view a domain or topic and characterize its elements changes quickly or frequently over time, without any clear justification. If instability is limiting, identify the factors that may explain this. Look for elements or characteristics that are more meaningful, or take more time to discuss the ratings or to gather the information needed to complete the exercise.

Resistance to change

There is resistance to change when people become aware of specific learning opportunities described above yet prefer to leave the views expressed in their analysis unchanged. If resistance to change is limiting, identify the factors that may explain this or take more time to discuss the topic, the elements, and their characteristics. Note that elements and characteristics (which reflect how people think) are generally more difficult to change compared with element ratings (which reflect what people think about the elements and characteristics).

ADAPTIVE LEARNING

Failure to predict

There is a failure to predict when experience and real events do not confirm the characteristics and the ratings applied to the elements in the analysis. To assess the predictive value of the analysis, select key characteristics and their opposites, and then identify indicators that define the meaning of each number on your rating scale. Collect reliable information on these indicators related to each element to see if the characteristics are relevant and the ratings are confirmed. If the failure to predict is limiting, change the ratings or look for characteristics that have better predictive value.
Ecological Domain examines how people view existing elements in nature using terms and characteristics that participants choose and negotiate. The tool may be used to classify things in nature (such as apple varieties or soil types) or ecological processes (such as indicators of climate change). The understanding of the domain may help people innovate, solve problems or test views against experience or other sources of knowledge.

Summary of this example: In March 2009 COPAGEN held in Dakar, Senegal a West African colloquium on strategies to preserve and promote peasant varieties of food plants, partly in response to the spread of genetically modified organisms (GMOs) in Africa. Participants tested Ecological Domain to see how the technique could help develop a strategic and methodical approach to promoting local knowledge on peasant seeds (different from the conventional use of questionnaires and interviews). To start the analysis, the participants identified six strategic and vulnerable food plants grown in their respective countries. They also identified a series of characteristics and their opposites that reflected three basic questions: in what way are the plants strategic, what makes them vulnerable, and what kind of action is being taken to preserve them. The results represented in the two graphs reveal that 4 of the 6 plants chosen by the participants are strategic because they produce rich and tasty food, serve multiple usages, and are vulnerable to drought. Actions to preserve two of them (Niebe peas, Red sorghum) involve marketing measures and customary rules of farmer behavior. The other two (Souna millet, Moutini millet) are preserved mostly through technical measures. By contrast, the remaining varieties (Laboko yam, Red Fyfe wheat) are particularly vulnerable to being contaminated by GMOs. These patterns, represented in the Principal Component graph, account for about 77% of the variance within the observed system (see percentages on the horizontal and vertical axes). Considering these findings, participants decided to explore other actions to preserve plants vulnerable to drought.
Activity Domain examines how people view existing activities or actions using terms and characteristics that participants choose and negotiate. The tool may be used to identify different types of actions or activities and explore associated levels of difficulty, forms of knowledge, benefits, the values or skills involved, etc. An understanding of the activity domain may help people innovate, solve problems or test views against experience or other sources of knowledge.

Summary of this example: In this organization, most knowledge sharing (KS) activities fall into two categories. On the one hand, KS that participants consider more useful to their work (on the left hand side) includes 'Structured reflection' (rated first), 'Writing report articles' and ‘Invited guests’ (both rated second), and ‘Evaluation committee meetings’ (rated third). These activities tend to be planned (‘purposeful’) and are done episodically. They involve an active sharing of information and filtered feedback on existing projects. Except for ‘Writing report articles’, more useful KS activities involve real-time teamwork. On the other hand, more time and resources are dedicated to less useful KS activities (on the right hand side) that are regular and unplanned (byproducts). These activities include ‘Circulating, posting and storing written information’ (rated fifth, the least useful) as well as ‘Written/verbal reports’ (on conferences, visits, etc.) and ‘Regular program staff meetings’ (both rated fourth). Except for ‘Regular program staff meetings’, these activities involve a passive sharing of knowledge, they are done individually, not in real-time (sequentially), and they contribute less to innovation. These patterns, represented in the Principal Component graph, account for about 83% of the variance within the observed system (see percentages on the horizontal and vertical axes). Based on this analysis, participants plan to allocate more time to useful KS activities, and do the less useful ones differently.
Problem Domain examines how people view existing problems using terms and characteristics that participants choose and negotiate. The tool may be used to identify different types of problems, levels of difficulty, responses adopted in the past, etc. The understanding of the problem domain may help people innovate, find appropriate solutions or test views against experience or other sources of knowledge.

Summary of this example: About 25 representatives of French-speaking African countries working on issues of natural resource management (NRM) identified the most frequent types of NRM conflicts occurring in their respective countries, such as between pastoralists and agriculturalists, elected locals and administrators, men and women, etc. They also identified contrasting characteristics to describe these conflicts. Each kind of conflict was rated against each characteristic and its opposite, using a scale of 1 to 9. The analysis showed that conflicts amongst agriculturalists and between agriculturalists and pastoralists are the most intense. Clashes between ethnic groups are also intense, although less so. All of these conflicts usually involve conflicts of status and interests and are addressed through management solutions. By contrast, tensions between funders and governments and between technical services and pastoralists are much less intense, they involve conflicts in power and ‘mission’, and they are addressed through technical solutions. Patterns represented in the Principal Component graph account for about 88% of the variance within the observed system (see percentages on the horizontal and vertical axes). Discussion focused on ways to introduce management solutions in less intense conflicts, and technical solutions in more intense conflicts, as complements to current strategies.
Option Domain examines how people view different proposed actions (options) using terms and criteria that participants choose and negotiate. The tool may be used to identify different kinds of options, evaluate them on specific criteria, establish priorities, and support decision making. The understanding of the option domain may help people innovate, solve problems or test views against experience or other sources of knowledge.

Summary of this example: About 2000 artisanal fishers exploit shellfish in the Common Fishery Zone of Ancud in central coastal Chile. The Fund for Fisheries Research invited some 57 fishers, officials and scientists to a two-day meeting to discuss better fishery management strategies in the zone. Participants identified seven possible actions together with seven criteria that could be used to evaluate the proposed actions. A scale of 1 to 7 was applied to each criterion. Participants noted that restricting access to the fishery may not be costly but will take time, is less feasible legally, and will generate some conflict, at least at the beginning. Better enforcement measures, while more feasible legally, are not going well and represent a costly, longer-term approach that depends more on other actors. As for raising government funding, this is and will continue to be difficult and depends on others. On the whole, mobilizing support for better management practices and forming representative bodies received the most favorable ratings. These patterns, represented in the Principal Component graph, account for about 70% of the variance within the observed system (see percentages on the horizontal and vertical axes).
**Social Domain**

*Social Domain* examines how people view themselves and others using terms and characteristics that participants choose and negotiate. The tool may be used to identify different groups or categories of stakeholders based on the types and levels of interests they have in a project or program; the forms and levels of organization or power they can apply to a situation; the degrees and ways in which they are trusted or viewed as legitimate by others; the actions or positions they take in a conflict; or the information, skills, values or leadership styles they might apply in a situation. The understanding of the social domain may help people innovate, solve problems or test views against experience or other sources of knowledge.

**Summary of this example:** Farmers grow tobacco on some 80,000 acres of agricultural land in Bangladesh, mainly under direct contract with the British American Tobacco Company. While tobacco is a cash crop for farmers, tobacco farming causes a wide range of environmental, social and health problems in farming communities. The Bangladesh non-governmental organization UBINIG is working with tobacco farmers who have expressed a desire to move away from tobacco into other kinds of farming. As it cannot work with all households at the same time, the project needed to form subgroups that could conduct and assess alternatives to tobacco. *Social Domain* was used to design strategies that reflect different farmer profiles. The exercise revealed that farmers were made up of households with one of four profiles: young tobacco farmers; older farmers with small areas of tobacco and food crops; tobacco traders with limited tobacco production of their own and; older, land-rich farmers with the flexibility to avoid tobacco farming. It also suggested that being involved in the tobacco trade is particularly important to land-poor farmers (such as Razzak, Azizul and Huq), giving them a distinct profile that should be taken into account when evaluating alternatives to tobacco production. These patterns, represented in the Principal Component graph, account for about 78% of the variance within the observed system (see percentages on the horizontal and vertical axes). A plan was developed to monitor the impact of alternatives to tobacco on the livelihood of households with these four distinct profiles.
**ADAPT**

*Social Domain* can also be facilitated **without the use of a table**, thereby focusing attention on the discussion and the active engagement of participants in describing meaningful similarities and differences between them. To achieve this,

**Step 1** Divide all participants into random **groups of three**. Ask each group of three to identify two people in the group (a pair) that are the same in some way relevant to the domain or topic, and different from the third. Find a characteristic that is shared by the pair, and then the characteristic that makes the third person different.

**Step 2** Make a list of the distinctions between **characteristics and their opposites** obtained from all the groups. Discuss and clarify the meaning of each distinction. Group together the distinctions that are the same. Reduce the list to 4 to 6 distinctions that matter the most in the domain or topic area. To help interpret the results of the analysis, rank the pairs of characteristics in order of importance (see *Tips on characteristics*).

**Step 3** Each participant **rates** himself or herself on each characteristic and its opposite, from 1 to 5. Ensure that participants have a common understanding of what the numbers on the scale mean for each characteristic and its opposite, or develop indicators. Each actor can record their ratings on a card showing the same characteristics, in the same order, and with the same format (see example card).

**Step 4** Ask each participant to find others that have cards with many row scores that are **identical or similar** (only one point apart in most rows) to theirs. Give special attention to similarities in the rows that describe the most important characteristics. Encourage all participants to compare their cards with others until groups or ‘families’ with similar profiles are formed.

**Step 5** **Groups formed** around similar cards can then prepare and present to the whole group a brief description of the **characteristics** group members have **in common**. When a group presents their profile, others groups can **move closer** if they feel they are similar in significant ways or **distance** themselves if the differences are more important than the similarities. At the end of the exercise, participants should discuss the main differences observed between groups and plan strategies that draw on different but complementary profiles.
Purpose
To identify entry points into a system based on an assessment of how elements in the system interact to create specific behaviors and situations.

PRINCIPLES
A system is a set of interacting and interdependent parts forming an integrated whole. Each part can best be understood in the context of relationships with other parts and the whole system, rather than in isolation. *System Dynamics* helps understand how people define and understand: 1) differences between parts of a system; 2) how parts interact with each other and relate to the whole and; 3) opportunities to challenge and improve both the parts and the whole.

Efforts to think and act ‘holistically’ depend on how people divide and define the parts of the whole. System parts and their relationships cannot be understood through universal categories that apply to all possible settings. They are always expressed with local color and meaning.

The method presented below is an adaptation of the input-output matrix used in economics to depict the interaction of sectors in an economy. Following are detailed instructions for the tool, which can be adapted and applied to any topic, including systems in nature (*Ecological Dynamics*), activities (*Activity Dynamics*), problems (*Causal Dynamics*), skills (*Skill Dynamics*), stakeholder behaviors (*Network Dynamics*), values (*Value Dynamics*) and social systems involving the interaction of actors, problems and actions (*Social Dynamics*) (see examples below).

Step 1 Define the topic area and identify the key elements or component parts of the system involved (see Free List and Pile Sort). These should be concrete, distinct and clearly described. If the elements are vague, use the Laddering Down method in Active Listening to make them more specific and meaningful. Ask “What do you mean by this?” or “Can you give an example of this?” Another option is to use description and storytelling to explore the topic, and then use this information to identify the elements. Write or draw each element on its own card, with details on the back of the card or on a flip chart. When using a standard matrix (see Tips, below, for alternatives), make a copy of each element card.

Step 2 Create a table on the floor or wall. Place one set of element cards in the top row and the other set (showing the same elements in the same order) in the first column.

Step 3 Decide on a rating scale to indicate the level of contribution that each element makes to other elements (for example, from 0 for no contribution to 10 for a critical contribution).

<table>
<thead>
<tr>
<th>Elements</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Total Dependence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

137
Step 4 Use the scale created in Step 3 to rate the level of contribution that each element currently makes to each other element. Ask ‘At what level does this (name the column element) contribute to that (name the row element)?’ Clarify the question and adapt it to the topic (see specific applications of System Dynamics). As in all rating exercises, the same score can be given to two or several elements.

Proceed with the rating exercise one column after another. Start by rating the extent to which element B contributes to the element heading the column A. This will ensure that the direction of the contribution is clear and consistent. If participants invert the question and indicate how A contributes to B, insert the score in the appropriate cell and return to the questioning by column.

Record each score on its own card and write the reason given for each score on the reverse side of its card or on a flip chart. Place the score cards in the appropriate rows and columns of the table. Leave empty all cells that combine an element with itself (A contributes to A), unless the element interacts with itself (as do members within a stakeholder group, for instance).

Step 5 Once the table is complete, total all scores in each row and write Total Contribution at the top of a new column to the right. Insert the total scores in this new column, in the appropriate rows. The column shows the total contribution of each row element to all other elements. (A different term for this column is used in Ecological Dynamics, Causal Dynamics and Network Dynamics.)

Step 6 Total all scores in each column and write Total Dependence at the beginning of a new row below. Insert the total score in this new row. This indicates the total dependence of the column element on all other elements. (A different term for this sum is used in Ecological Dynamics, Causal Dynamics and Network Dynamics.)

Step 7 Calculate the dynamic interaction between all elements by totaling all contribution scores (or dependency scores) and dividing the result by the maximum total score that could be obtained if all cells in a row (or the column) received the highest rating in the range. Insert the resulting percentage figure at the bottom of the last column.

Step 8 Create a diagram by drawing a vertical line that crosses a horizontal line of equal length. Write or draw a symbol representing the topic (identified in Step 1) above the diagram. Write at opposite ends of the vertical and horizontal lines the minimum score (usually 0) and the maximum possible score that could be obtained if all cells in a row or column received the highest rating in the range (for instance, the maximum total score that can be obtained with four elements interacting, using a scale of 0 to 10, is 30). Insert the number that represents the middle score (the sum of maximum scores in a row divided by two) where the lines cross. The vertical line indicates the Total Contribution of an element (its row total) and the horizontal line, its Total Dependence (or column total).
Step 9  **Label** the four corners of the diagram with the result obtained by combining the possible outcomes of each axis: elements that contribute and depend more (top right); those that contribute more and depend less (top left); those that contribute less and depend more (bottom right); those that contribute and depend less (bottom left). To facilitate the analysis, find an idea or a symbol to represent each corner of the diagram. Elements that contribute and depend less may be important even if they interact little with other elements in the system.

Step 10  To **locate each element** in the diagram, mark where the element’s total contribution score is located on the vertical line and the element’s total dependence score is located on the horizontal line. Draw a line from each location and insert the name of the element where the two lines meet.

Step 11  Include in the diagram **other information** that may be useful for the analysis, such as the overall level of control that stakeholders have over each element in the system, the time and level of effort it would take to act on it or the order in which people plan to act on certain elements. Use a **code** (such as capital letters, numbers, colors or circles) to identify elements with these characteristics (see examples below).

**Scores that contradict** the main tendencies of the diagram may also be important and affect the interpretation of results; one element that contributes little to other elements may still contribute a lot to one important element, for instance. To identify these contradictory scores, compare each cell score appearing in the rating table with the average row score to see if both scores are on the same lower side or upper side of the middle point of the scale (5 in a scale of 0 to 10, for instance). If a cell score is **not** on the same side as the average row score, compare the score with the average column score to see if both scores are on the same lower side or upper side of the middle point of the scale. If the cell score is **not** on the same side again, draw a circle around it. Once these contradictory scores are identified, draw arrows in the diagram to indicate the relationships that **contradict the main tendencies** of the system. Use **continuous arrows** for scores above the middle point of the scale. These indicate bottom-side elements that contribute significantly to some elements located on the left side of the diagram (see example in *Skill Dynamics*). Use **broken arrows** for scores below the middle point. These indicate upper-side elements that do **not** contribute significantly to some elements located on the right side of the diagram (see example in *Causal Dynamics*).
INTERPRETING THE RESULTS

Step 12  Discuss the overall level of **dynamic interaction** of the elements calculated in Step 7 and review the location of the elements in the diagram, considering three possible scenarios: integration, hierarchy or dispersion.

- There is **integration** in the system when many elements are located in the top-right section of the diagram. This usually reflects a high score for dynamic interaction (above 60%, as calculated in Step 7). In an integrated system increasing or decreasing the contribution of one element in the top-right section may in turn affect the level of contribution of all other elements located in the same section. The result is a chain effect that influences the dynamic interaction of all elements, including the element that receives initial attention (see example in *Causal Dynamics*).

- There is **hierarchy** in the system when the diagram consists mostly of top-left elements and bottom-right elements. This usually reflects a middle score for dynamic interaction (between 40% and 60%, as calculated in Step 7). In a hierarchical system, attention to elements in the top-left section will automatically have an influence on the bottom-right elements (see example in *Social Dynamics*).

- There is **dispersion** in the system when the diagram consists mostly of elements in the bottom-left section of the diagram. This usually reflects a low score for dynamic interaction (below 40%, as calculated in Step 7). Elements in this section may be important even if they interact little with other elements in the system. In a dispersed system, the elements interact little and can only be modified through direct actions (see *Activity Dynamics*).

Step 13  **Summarize** the scenario or combination of scenarios that best describe the results in the diagram. Discuss the way that participants reached decisions at each step, the elements included and left out of the analysis, the kind of information or knowledge used to rate the elements, the contradictions identified and the other information added in Step 11. If need be, modify one or several elements considering the discussion, and recalculate the overall interaction of all elements (see Step 7). When completed, use this analysis to identify system entry points, rethink priorities or modify some elements so that they **interact differently** with the other elements.
TIPS

☐ Be sure to review in detail the Tips for Free List and Pile Sort, Ranking and Rating. These are critical to proper application of System Dynamics.

☐ The elements used in System Dynamics can be real or proposed.

☐ If some elements have a negative impact on other elements, use a scale that has negative scores (from –10 to 10, for instance; see Ecological Dynamics). Negative scores reflect conflict in the system.

☐ To focus on the rating discussion rather than the table, use a flip chart to represent each column element. On each flip chart place the rating cards that indicate the contributions other elements make to the flip chart element. Once the flip charts are completed, compile the scores in a table and go on directly to the diagram in Step 8. Another option is to make only one set of element cards and place these in a column in plain view of all participants. When discussing the elements, move the top card to one side and begin by asking to what extent do the remaining column cards contribute to the element set to one side. Continue this line of questioning down the column, always referring to the isolated element card. Once these relationships have been scored and recorded in a table, return the top card to the column and pull out the next element card. All cards remaining in the column can then be discussed as elements contributing to the isolated card. Continue until all interactions have been assessed and recorded. Once the scores are compiled in a table review the process and go on to the diagram in Step 8. This procedure lends itself to a direct conversational style of facilitation focusing on rating of the elements rather than the construction of a table. It also makes it easier to use objects instead of element cards, and work in a smaller space.

☐ To compare current levels of interaction between elements with levels people are aiming for in the future, divide each cell of the table created in Step 2 into two parts and insert a score in each part: the first score to describe the actual contribution that an element makes to another, and the second score to describe the ideal contribution it should make.
## System Dynamics

<table>
<thead>
<tr>
<th>Elements</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Dependance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ecological Dynamics helps describe how the components of an ecological system interact with each other. The tool may be used to support systems thinking concerning things in nature (such as plant species and varieties) or ecological processes (such as soil degradation or the dynamics of pollution). The understanding of the system may help people decide where to focus attention and what relationships to change.

Ecological Dynamics begins by defining an ecological system and listing the components of the system. The rating scale can include negative as well as positive values (for example, -10 to +10). It focuses on the extent to which one component provides benefits to or harms other components in the system, and the extent to which each is helped by or harmed by other components. These can be seen as relations of cooperation (each component derives a benefit) or relations of exploitation or competition (each component benefits at the expense of the other). When rating, ask "To what extent does this component (name the row component) provide benefits to or harm that component (name the column component)?" When both situations apply, estimate the net effect. The resulting matrix produces an index for helps/harms other components (vertical axis) and an index for is helped by/harmed by other components (horizontal axis). See System Dynamics for detailed instructions.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Rice</th>
<th>Maize</th>
<th>Sorghum</th>
<th>Barbaty bean</th>
<th>Pearl millet</th>
<th>Black gram</th>
<th>Sesame</th>
<th>Pigeon pea</th>
<th>Green gram</th>
<th>Total Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-3</td>
<td>0</td>
<td>-3</td>
<td>0</td>
<td>-6</td>
</tr>
<tr>
<td>Maize</td>
<td>-2</td>
<td>x</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Sorghum</td>
<td>-3</td>
<td>0</td>
<td>x</td>
<td>5</td>
<td>0</td>
<td>-4</td>
<td>0</td>
<td>-4</td>
<td>-4</td>
<td>-10</td>
</tr>
<tr>
<td>Barbaty bean</td>
<td>-5</td>
<td>-3</td>
<td>0</td>
<td>x</td>
<td>0</td>
<td>-3</td>
<td>-4</td>
<td>-2</td>
<td>-3</td>
<td>-20</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>-4</td>
<td>-5</td>
<td>0</td>
<td>5</td>
<td>x</td>
<td>-3</td>
<td>0</td>
<td>-4</td>
<td>-3</td>
<td>-14</td>
</tr>
<tr>
<td>Black gram</td>
<td>-3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Sesame</td>
<td>-5</td>
<td>2</td>
<td>-3</td>
<td>-5</td>
<td>-5</td>
<td>0</td>
<td>x</td>
<td>-1</td>
<td>0</td>
<td>-17</td>
</tr>
<tr>
<td>Pigeon pea</td>
<td>-5</td>
<td>0</td>
<td>-2</td>
<td>4</td>
<td>-2</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>Green gram</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>-3</td>
<td>-3</td>
</tr>
<tr>
<td>Total Dependence</td>
<td>-27</td>
<td>-6</td>
<td>-5</td>
<td>11</td>
<td>-5</td>
<td>-13</td>
<td>-1</td>
<td>-11</td>
<td>-13</td>
<td>-70</td>
</tr>
</tbody>
</table>
Summary of this example: In this Indian mixed cropping system the most important crops (marked with circles) are rice, pigeon peas, and sorghum. The analysis shows that some crops interact in positive ways. For instance, maize generally affects other crops positively and is also positively affected by sesame cultivation. Also, the growth of barbaty bean vines benefits significantly from climbing on the stalks of maize, sorghum, millet, and pigeon pea (see arrow). On the whole, however, the diagram indicates that most crops affect other crops in slightly negative ways. Farmers reduce these exploitative relationships by adjusting how much of each crop they sow. For example, they may increase the ratio of rice in their field while reducing the ratio of pearl millet. They also assume that unpredictable environmental factors will cause some crops to produce little or fail. When this happens, competition is also eliminated, allowing the remaining crops to produce better. (Source: Colin Lundy, 2006. Growing Seed Knowledge: Shifting Cultivation and Agricultural Biodiversity among Adivasi Communities in India. MA Thesis in Anthropology, Carleton University, Ottawa)
Causal Dynamics helps assess how factors related to a key problem interact. The tool may be used to support systems thinking concerning how to act on a problem through particular factors in the system (entry points).

Causal Dynamics focuses on relationships of cause and effect rather than relations of contribution and dependence explored in most other applications of System Dynamics. It begins by defining a key problem and listing the factors involved. Include the key problem in the rating matrix if it interacts with other factors directly. Leave the key problem out of the rating matrix if the factors are manifestations or examples of the key problem.

When rating, ask ‘To what extent does this (name the row element) cause that (name the column element)?’ or ‘At what level does this (name the row element) produce that (name the column element) as a consequence?’ The resulting matrix produces a cause index at the end of each row in the table (vertical axis in the diagram) and an effect index at the bottom of each column (horizontal axis in the diagram). Label the four corners of the diagram with the result obtained by combining the possible outcomes of each axis: factors that are pure causes of other factors (upper-left corner of the diagram), factors that are pure effects of other factors (bottom-right corner), factors that are both causes and effects (upper-right corner) and factors that are independent of each other (lower-left corner). See System Dynamics for detailed instructions.

ADVANCED VERSION

Apparent and Real Weight

Some factors at the root of a key problem may have to be addressed directly even if they interact with other factors. To identify these, distinguish between the apparent and real weight of each factor.

- After defining the key problem and identifying the factors involved (Step 1), estimate how important each factor is in relation to the key problem. This is the apparent weight of each factor, and reflects initial thinking about the weight of factors in a given context. Estimate the apparent weight using a rating scale of 1 to 10 and write the result in the corresponding cell in the top row of the table and the sum in the last cell. Factors with apparent weights of less than 3 are very weak causes of the key problem and should be left out of the analysis.

- Complete Steps 4 to 8 and then revisit the weight of each factor. Estimate how important the factor would be if all the other factors were eliminated or did not exist. This is the real weight of each factor and reflects thinking informed by the rating exercise regarding the weight of each factor in isolation from other factors included in the analysis. Use the same rating scale, making sure that the real weight is less than or the same as the factor’s apparent weight. Write the score next to the apparent weight in the corresponding cell in the top row of the table and the sum in the last cell.

- Complete other steps including a diagram with the results (Steps 8 to 11). Review the apparent and real weight for each factor and adjust the size of the dot assigned to each factor. Use bigger dots when the real weight of a factor is the same or close to its apparent weight as this indicates that it will remain significant even when other factors are eliminated. Give special attention to these factors when interpreting the results. Factors that do not loose much of their real weight when other factors are addressed are persistent causes and may require more direct attention than initially thought.
Summary of this example (see next page): This organization feels that the way it manages knowledge is not as useful to its members as it should be. Using the Causal Dynamics technique (and a rating scale of 0 to 10), participants choose to focus on the key factors in the top right of the diagram — factors that are both causes and effects of the problem. They discover that their non-strategic management of human resources (poor human resource management strategy) is a major contributing factor. Since they have some control (marked in green) over this factor, they decide to free up some resources and use them to innovate in the field of Knowledge Management (KM). They can innovate despite their donor’s accounting approach to KM and the organization’s overemphasis on periodic accounts of measurable results, factors over which they have little control (marked in red). Once these initial actions (numbered 1 in parentheses) are taken, the organization will explore better ways to involve their partners in KM activities, a goal that will take time. Other objectives, such as rethinking the organization’s dependence on a principal donor, are less urgent. In the long run, the organization may want to act on this independent factor directly or through causes not identified in this analysis.
Factor Integration Level

Step 7 in System Dynamics involves the calculation of the dynamic interaction between all elements. In the advanced version of Causal Dynamics this calculation may be influenced by persistent factors (factors with a real weight that is similar to its apparent weight). To calculate the Factor Interaction Level (FIL), multiply the Total Cause Index % (the percentage figure at the bottom of the last column) by the Total Real Weight Reduction. The Total Real Weight Reduction is the Total Apparent Weight (the sum of all apparent weights recorded in the last column) minus the Total Real Weight (the total of all real weights recorded in the last column), divided by the Total Apparent Weight. In short: FIL = Total Cause Index % x (Total Apparent Weight – Total Real Weight) / Total Apparent Weight. In the example provided, the Total Cause Index % is 55.7%, or 234/420. The Real Weight Reduction is 45.1%, or (51 – 28)/51. Thus the Factor Interaction Level is about 25%, or 55.7% x 45.1%, a moderate FIL. This measure helps to guide interpretation considering the three possible scenarios described under System Dynamics: integration, hierarchy and dispersion.

Legend: The size of each dot indicates the real weight of the factor. Green means participants have some control over the factor; red indicates little or no control. Numbers in parentheses reflect the order in which participants plan to act on each factor. Broken arrows indicate a weak causal relationship (contradicting main tendencies in the diagram).
Activity Dynamics helps describe how activities in a project or program interact with each other. The tool may be used to support systems thinking concerning how to increase synergy among activities and improve the overall efficiency and effectiveness of the system.

Activity Dynamics begins by defining a set of actions, a project or a program and listing the activities involved. It focuses on the extent to which one activity contributes to or depends on other activities. When rating, ask 'To what extent does this activity (name the row activity) contribute to that activity (name the column activity),'# The resulting matrix produces an index for contributes to other activities (vertical axis) and an index for depends on other activities (horizontal axis). See System Dynamics for detailed instructions.

Summary of this example: This project involves research and action mostly, with some training. On the whole, the interaction between the corresponding activities is very weak; each activity makes a limited contribution to other activities. Data collection and analysis contributes the most, and lobbying depends the most on other activities. Changing how these activities are carried out could increase synergies.
Skill Dynamics helps assess how each skill applied to a set of activities, project or program contributes to other skills and depends on them at the same time. The tool may be used to support systems thinking concerning the skills required in a situation and how to mobilize and create synergies between the skills of different actors in the system.

Skill Dynamics begins by defining a set of activities, a project or a program and listing the skills involved. It focuses on the extent to which one skill contributes to or depends on other skills. When rating, ask ‘To what extent does this skill (name the row skill) contribute to that skill (name the column skill)?’ The resulting matrix produces an index for contributes to other skills (vertical axis) and an index for depends on other skills (horizontal axis). See System Dynamics for detailed instructions.

Summary of this example: Training and analysis (circled) are the skills with the highest levels of satisfaction. Together with writing they contribute the most to other skills. Skills in theory and visual design are helpful when doing analysis, and languages are helpful when doing networking (see arrows in the graph). By contrast, networking skills contribute little to other skills in this system.

<table>
<thead>
<tr>
<th>Skills</th>
<th>Analysis</th>
<th>Training</th>
<th>Languages</th>
<th>Networking</th>
<th>Visual design</th>
<th>Theory</th>
<th>Writing</th>
<th>Total contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>x</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>34/60</td>
</tr>
<tr>
<td>Training</td>
<td>5</td>
<td>x</td>
<td>4</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>37/60</td>
</tr>
<tr>
<td>Languages</td>
<td>1</td>
<td>9</td>
<td>x</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>30/60</td>
</tr>
<tr>
<td>Networking</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7/60</td>
</tr>
<tr>
<td>Visual design</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>x</td>
<td>4</td>
<td>6</td>
<td>25/60</td>
</tr>
<tr>
<td>Theory</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>x</td>
<td>7</td>
<td>25/60</td>
</tr>
<tr>
<td>Writing</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>x</td>
<td>31/60</td>
</tr>
<tr>
<td>Total dependence</td>
<td>26/60</td>
<td>41/60</td>
<td>16/60</td>
<td>22/60</td>
<td>18/60</td>
<td>28/60</td>
<td>38/60</td>
<td>189/420 (45%)</td>
</tr>
</tbody>
</table>
Network Dynamics helps assess the network of influence, trust or information that exists between stakeholders involved in a particular situation or project.

*Network Dynamics* begins by defining a **situation or project** and listing the **stakeholders involved**. It focuses on **one kind of network** at a time (influence, trust or information) and assesses the extent to which one stakeholder networks with other stakeholders. See *System Dynamics* for detailed instructions.

- **A network of influence** (or power) is a set of connections where people use their prestige, wealth, knowledge or position to affect other people’s decisions. When rating, ask ‘To what extent does this stakeholder (name the row stakeholder) influence that stakeholder (name the column stakeholder)?’ The resulting matrix produces an index for *influences others* (vertical axis) and an index for *is influenced by others* (horizontal axis).

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Small farmers</th>
<th>Municipal authorities</th>
<th>Ranchers association</th>
<th>Agricultural laborers</th>
<th>Catholic Church</th>
<th>NGO</th>
<th>Teachers</th>
<th>Trusting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small farmers</td>
<td>x</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>22/42</td>
</tr>
<tr>
<td>Municipal authorities</td>
<td>3</td>
<td>x</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>16/42</td>
</tr>
<tr>
<td>Ranchers association</td>
<td>4</td>
<td>7</td>
<td>x</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>19/42</td>
</tr>
<tr>
<td>Agricultural laborers</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>x</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>18/42</td>
</tr>
<tr>
<td>Catholic Church</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>x</td>
<td>5</td>
<td>7</td>
<td>35/42</td>
</tr>
<tr>
<td>NGO</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>x</td>
<td>2</td>
<td>13/42</td>
</tr>
<tr>
<td>Teachers</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>x</td>
<td>31/42</td>
</tr>
<tr>
<td>Trusted</td>
<td>25/42</td>
<td>18/42</td>
<td>18/42</td>
<td>23/42</td>
<td>28/42</td>
<td>19/42</td>
<td>23/42</td>
<td>154/294 (52.4%)</td>
</tr>
</tbody>
</table>

- **A network of trust** is a set of connections where people show confidence in other parties and rely on them to provide support, to behave in appropriate ways, and to do what they are expected to do. When rating, ask ‘To what extent does this stakeholder (name the row stakeholder) trust that stakeholder (name the column stakeholder)?’ The resulting matrix produces an index for *trusts others* (vertical axis) and an index for *is trusted by others* (horizontal axis).

- **A network of information** is a set of connections where people pass on knowledge or views to other people. When rating, ask ‘To what extent does this stakeholder (name the row stakeholder) provide information to that stakeholder (name the column stakeholder)?’ The resulting matrix produces an index for *informs others* (vertical axis) and an index for *is informed by others* (horizontal axis).
Social Dynamics, also known as Symphony, helps assess the ways in which key stakeholders, key problems and significant actions influence each other in a particular situation.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Lowland expropriation</th>
<th>Upland redistribution</th>
<th>Lack of information</th>
<th>Violence</th>
<th>Small farmers</th>
<th>Municipal authorities</th>
<th>Federal government</th>
<th>Total contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowland expropriation</td>
<td>x</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>10</td>
<td>49/60</td>
</tr>
<tr>
<td>Upland redistribution</td>
<td>2</td>
<td>x</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>7</td>
<td>1</td>
<td>25/60</td>
</tr>
<tr>
<td>Lack of information</td>
<td>6</td>
<td>5</td>
<td>x</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>34/60</td>
</tr>
<tr>
<td>Violence</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>29/60</td>
</tr>
<tr>
<td>Small farmers</td>
<td>2</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>x</td>
<td>4</td>
<td>2</td>
<td>21/60</td>
</tr>
<tr>
<td>Municipal authorities</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>x</td>
<td>4</td>
<td>27/60</td>
</tr>
<tr>
<td>Federal government</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>x</td>
<td>4</td>
<td>47/60</td>
</tr>
<tr>
<td>Total dependence</td>
<td>27/60</td>
<td>37/60</td>
<td>25/60</td>
<td>31/60</td>
<td>47/60</td>
<td>44/60</td>
<td>21/60</td>
<td>232/420 (55%)</td>
</tr>
</tbody>
</table>

**Social Dynamics** begins by defining a **situation** and listing the key stakeholders, problems and actions involved. It focuses on the extent to which one element in the situation interacts with others. When rating, ask ‘To what extent does this (name the row element) affect or influence that (name the column element)?’ The resulting matrix produces an index for **influences other elements** (vertical axis) and an index for **depends on other elements** (horizontal axis). See System Dynamics for detailed instructions.

**Summary of this example**: The federal government is actively supporting current plans to *expropriate* half of the communal lowlands. This has led to acts of *violence*, which may affect the federal government’s public image and power to expropriate the land (see continuous arrow in the diagram). Violence is the result of a threat to the communal land tenure system, yet this response (together with more information on communal land entitlements) may force the federal government to pressure the municipal authorities to endorse the small farmers’ proposal to *redistribute* the remaining communal uplands as individual plots.
Value Dynamics helps assess how the values, moral principles or rules of ethical conduct that people adopt when taking a position or acting on a key problem interact with each other. The tool may be used to describe and reflect on the integration of supporting values (acting as means) and values expressing end goals.

Value Dynamics begins by defining a key problem or a set of actions and listing the values people apply and refer to in relation to the problem or actions. It focuses on the extent to which one value supports and is supported by other values people apply to the problem or action. When rating, ask ‘To what extent does the application of this value (name the row value) support the application of that value (name the column value)?’ The resulting matrix produces an index for supports other values (vertical axis) and an index for is supported by other values (horizontal axis).

The value system resulting from the analysis can be interpreted considering three possible scenarios: integration, hierarchy and fragmentation. In an integrated value system, values support each other, acting as rules of ethical conduct and end goals at the same time (top-right section). In a hierarchical value system, top left rules of ethical conduct support bottom right end goals. In a fragmented value system, moral principles and rules of ethical conduct interact little and are applied to the key problem independently of each other. See System Dynamics for detailed instructions.

**Summary of this example:** In this project achieving peace and a better understanding of reality are supporting values and end goals at the same time. They represent core values that support and are supported by other values in the system. Dialogue and fairness play the role of supporting values (or means), while development is mostly at the receiving end of other values (an end goal).