MIXED CROPPING SYSTEMS OF ADIVASI PEOPLES IN INDIA USING THE DOMAIN ANALYSIS PARTICIPATORY TECHNIQUE

By Colin Lundy

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Introduction

Since the early 1990s, small grassroots development organizations have achieved notable successes with participatory research and development. As a result, national and even multilateral organizations have faced increasing pressure to also adopt participatory ideas and techniques. Now virtually all development organizations demand local participation on some level in at least some part of their project implementation.

The benefits of participatory research and development systems such as Participatory Rural Appraisal (PRA) are well documented and supported (see for example Pratt 2001; Opp 1998; Whyte 1991). In brief, the research techniques are interactive, visual and tactile, so that anyone can participate regardless of age, social status or level of education. Secondly, participating people maintain ownership of their knowledge and of development processes. Furthermore, they are encouraged to use their knowledge to serve their own development needs rather than having an outside party decide what is good for them. The sense of ownership feeds into a third benefit, which is that “participation” is empowering for local people because they are looked upon as the experts harbouring valuable knowledge. In general, the results are that development projects are more appropriate in both scale and substance. Therefore, they are also more successful because they actually reflect the needs and wants of the stakeholders who are most impacted.

However, as participatory systems are increasingly applied on a larger and larger scale, they are criticized for often falling short of meeting their ideal goals. The above mentioned benefits are only benefits if “participation” is enlisted from local people with the best intentions, behaviours and attitudes (Opp 1998). Critics are arguing that knowledge elicited using participatory methods are at best superficial due to rigid applications of techniques stripped of their theoretical underpinnings, a lack of investment in time, money and rigorous preliminary social research, and the alienation of knowledge from participants as it is taken to outsider “experts” for analysis. As a result, participants do not actually receive any benefit to participating, leading them to offer little support and even resisting research and development proposals. In other words, research and development projects are not achieving their potential for success (Chevalier and Buckles 2005; 2005b; Kapoor 2002; Li 2002; Campbell 2001; Pratt 2001; Gomez 1999; Sillitoe 1998; Opp 1998; Mosse 1998; 1994).

Given the growing body of literature criticizing PRA and other existing systems of participatory research, Drs. Jacques Chevalier and Daniel Buckles developed the Social Analysis System^2 (SAS^2) with funding from International Development Research Centre (IDRC) in Ottawa, Canada.[1] SAS^2 builds on the established legacies of its

1 See the Social Analysis System^2 website at www.sas2.net

participatory predecessors, as well as draws from disciplines as diverse as economics, management, anthropology, sociology and psychology in the development of new techniques. Therefore, SAS^2 introduces new "concepts and tools for collaborative research and social action" (Chevalier and Buckles 2005: 2) urgently needed in the fields of research and development that can be adapted to any situation with both rigour and flexibility.

For this study, SAS^2 offers new ways of using participatory approaches to learn indigenous knowledge regarding mixed cropping agricultural systems.[2] To learn this knowledge, I focus on one of the SAS^2 signature techniques called Domain Analysis. Between December 2004 and February 2005, I worked with two *Adivasi*[3] tribes in India, the Korku people and the Kuvi people. Each of these peoples employs their own distinct method of mixed cropping, specifically designed to maintain a sustainable and secure – albeit modest – economy.

SAS^2

Two fundamental concepts within SAS^2 contribute to its improvements over other participatory systems. Firstly, SAS^2 aims to "make participatory methods and tools more rigorous" (Chevalier 2006/03/05), not only to assess the complexity of social processes that affect development projects, but also for collaboratively generating knowledge and extending that knowledge to propose development action. Furthermore, this can be achieved entirely within a local paradigm (Chevalier and Buckles 2005: 10). For example, certain SAS^2 techniques can be used to analyze relationships between participants and characterize them into stakeholder groups. This allows practitioners to facilitate "strategic engagement" between different stakeholder groups, working collaboratively or separately according to what is appropriate for the situation and the stakeholders' objectives (Chevalier and Buckles 2005; Kapoor 2002: 106; Campbell 2001: 382).[4] SAS^2 also adds rigour to participatory development by going beyond simply generating empirical knowledge and transferring it between stakeholders. Instead, participatory methodological processes can be followed through for analyzing knowledge, and then utilizing that knowledge to establish new learning experiences. This can be achieved either by continuing a particular participatory technique toward that end, or by taking knowledge generated using one technique and employing it with another technique in order to develop practical solutions in a participatory way (Chevalier and Buckles 2005: 59).

The sequential use of SAS^2 techniques brings me to the second concept which makes SAS^2 more affective than other participatory models. Each SAS^2 techniques has a flexibility scale built into its application. In contrast to Result-based Management, SAS^2 emphasizes "continuous planning" for managing research and development projects through an approach called "Process Management" (PMt) (Chevalier and Buckles 2005b: 5-6). PMt stays true to participatory ideology by remaining flexible regarding how goals

2 This article draws from my M.A. thesis "Wither biodiversity, whither food security? Participatory analyses of mixed cropping systems with Adivasi communities in India," Department of Sociology and Anthropology, Carleton University.
3 Adivasi is the general term used in India to refer to "Scheduled Tribes", or Indigenous peoples.
4 Contrast this with the PRA approach to participation, which is to include as wide and as general representation of people as possible, at the cost of stifling participation and knowledge generation and even fomenting conflict.

are identified and achieved. Since the outcomes of participatory exercises cannot be predicted, gaps and holes should be left in a project plan. These can only be filled once sufficient knowledge has been obtained using participatory techniques to determine what would be the next appropriate plan of action (Chevalier and Buckles 2005b: 7). Another way in which SAS^2 is flexible is that each technique follows a sliding rule principle. This allows practitioners to use advanced or simple versions depending on capabilities of the participants, time available for research and the level of detail necessary to meet participants' and researchers' objectives. More specifically, the techniques can be employed along a scale "between analytical reasoning and narrative account" (Chevalier and Buckles 2005: 38-9) to adapt to specific socio-cultural contexts (see also Roy and Chattergee 1993: 350-1; Jewitt 1995: 1018). For example, an exercise involving a complex matrix with numbers and indicators may be useful for some stakeholders, but may be a deterrent for the participation of others. In the latter case, it may be better to adjust the technique to fit a local paradigm, such as storytelling rather than using a structured analysis.

Between the flexibility of PMt and the mechanics of employing techniques, and the analytical rigour of techniques, SAS^2 has one more key feature. SAS^2 acknowledges that different stakeholders "may pursue different goals and activities even when they collaborate in particular projects and programs." However, to avoid the stagnation that comes with conflict, these goals "need to be acknowledged if they are to be openly negotiated" (Chevalier and Buckles 2005b: 4-5). The flexibility of the tools is such that an exercise closer to the "analytical reasoning" pole of the scale can be reiterated as a "narrative account" in order to accurately and sensitively convey the goals and activities of one stakeholder group to another (and *vice versa*) (Chevalier and Buckles 2005: 38). The benefits of these characteristics of SAS^2 are that stakeholders are encouraged to participate genuinely, since efforts are made to match participatory exercises to the needs and desires of participants. This in turn promotes a level of rapport that generates genuine and authentic knowledge, relevant goals and objectives, and a commitment on the part of participants to achieve goals and objectives.

The above is only a very brief description of SAS^2 principles. These principles can be studied in more detail by visiting the SAS^2 website at www.sas2.net. However, the remainder of this paper will be discussing Domain Analysis, one of the over fifty SAS^2 techniques. Many of the principles to be discussed about Domain Analysis are directly relevant to SAS^2 as a whole.

Case Studies

In discussing the analysis of Domain Analysis rep grids, I will utilize two case studies based on research with *Adivasi* mixed cropping farmers in India. First, however, a very brief overview is necessary to contextualize the farming situations for both the Kuvi (also called Dongria Kondh) and Korku *Adivasi* farmers.[5] Until recently, the Kuvi people's remote and mountainous homeland, and their attitudes towards others, has resulted in very little external influence on Kuvi society and its subsistence oriented economy (see also Vandergeest and Peluso 1995; Nayak et al 1999). They occupy the

5 There is not space here to include a sufficient ethnographic account of the culture and economy of either the Kuvi or the Korku people. For Kuvi ethnography, see Das (2001), Nayak and Soreng (1999), Patnaik (1989), Padhy (1998) and the journal *Adibasi*. For the Korku, see Deogaonkar (1990) and Fuchs (1988).

foothills of the Eastern Ghats, in Orissa state, where they practice rotational shifting cultivation. Simply put, this means that a farming family cuts down a section of forest on the hillside, lets it dry, burn it and then sow seeds into the ashes. The ashes give enough fertility to the soil to allow Kuvi farmers to cultivate here for three years before abandoning the hill to allow the forest to regenerate. At this point, they cut down another section of forest, one that they had abandoned about ten or so years before. The same family always returns to the same plots for cultivation (Nayak and Soreng 1999; Schmidt-Voigt 1997; Grandstaff 1980). This long fallow period is just one of many strategies that Kuvi people use to conserve soil, water, and forest resources (Katragumma 2005/01/04; Mangaraj and Allim 2005/01/15; Patra 2005/01/16; Pattanaik 1998: 116; Schmidt-Voigt 1997; Grandstaff 1980).

The actual mixed cropping system employed by the Kuvi people is a "seed-mix" because they mix together the seeds from about twenty-five different crops and then broadcast them over the fields. The types of crops include grains, legumes, oilseeds, and vegetables. The seemingly random method of sowing seeds gives the effect that the fields are natural extensions of the surrounding forest ecosystem. While the dense and multistory plant canopy may reduce overall yields by forcing crops to compete with each other, it is also effective for preventing sunlight from reaching the soil surface, which in turn prevents weed growth, moisture evapouration and soil erosion. Gradually the crops ripen, each at a different time. Only the seed heads, and when applicable vegetables, are harvested, leaving as much plant material in the field as possible to, again, protect resources as well as to provide tinder for burning at the beginning of the next season.

The Korku people occupy the low, rolling Satpuri Hills along the Tapti River in the states of Madhya Pradesh and Maharashtra. While the landscape is rugged and marginal, it is less so than for Kuvi farmers. Neither are Korku farmers in general as isolated. Interaction with other *Adivasi* peoples as well as the dominant Hindu population, who farm large monocrops of sugar cane and cotton, are common. Thus, Korku society exhibits a certain amount of assimilation into the surrounding societies, although it remains distinct overall. This acculturation is apparent in their mixed cropping system. Like the Kuvi, the Korku farmers have about twenty-five different crops. However, the Korku have few vegetables and no root crops in their system. Furthermore, they only include about eight crops in a seed-mix, which is restricted to only certain sections of their fields. The other dozen or so crops are sown separately either in alternating stands (intercropped), in succession according to season, or in ecologically appropriate areas of the farm, so that the Korku field looks like a patchwork of small stands of single crops. I call this an "integrated" mixed cropping system because farmers integrate seed mixing with intercropping, and the latter may include traditional crops as well as new market oriented crops, some being hybrid high yielding varieties (HYV).

Korku soil is poor and prone to erosion. Natural soil fertility comes only from nitrogen fixation from legume crops, as well as decomposition of a small amount of crop residue left in the fields and a small amount of manure from grazing animals on the fields after the harvest. Regardless, like the general population, Korku farmers intensify their land-use and increase their yields by utilizing oxen for ploughing fields, drilling seeds of single crop types, and cultivating weeds. Under certain circumstances, they also use chemical fertilizer (urea) to boost soil output.

Both Kuvi and Korku peoples are marginalized *Adivasi* farmers whose respective homeland ecosystems pose several challenges to their livelihoods. Mixed cropping is claimed by both as a method for ensuring economic security, which I define broadly to include food/nutrition, medicine, fodder, fibre and construction, and financial securities. One advantage of mixed cropping is that farmers say it saves them labour in sowing, weeding and managing their land. More importantly, mixed cropping systems are resilient against failure due to uncontrollable ecological conditions. The farmers' logic is that if conditions occur to cause certain crops to fail, other crops will thrive under those same conditions. Therefore, there will always be a successful yield. Scientists agree with these claims and add that mixed cropping may encourage the conservation of water and soil resources (Jewitt 2002: 159-68; Marten 2001: 167-74; Thrupp 2000: 268; Renauld et al 1998: 345; Cleveland 1997: 481; Sharma 1994: 143; Altieri et al 1987: 50).

Domain Analysis rep grids utilized in this research seek to identify more subtle knowledge directly from farmers to substantiate the above claims. In addition, Domain Analysis allows a forum for farmers to describe how their cropping systems are diverse to them, and to identify new values to mixed cropping. What the rep grids reveal is that the Kuvi system is more diverse, more labour saving, more sustainable, and thus maybe more resilient to environmental factors than the Korku system. Nonetheless, although the Korku system employs less diversity of crops, Korku farmers "integrate" nationally valued cash crops and utilize methods to increase yields, thus increasing their security by diversifying their economy. Furthermore, their claims are still legitimate because they can only compare themselves to the monocropping practices of the mainstream Hindu valley farmers, which is even less diverse and resilient. Monocropping with hybrid technologies is only lucrative under ideal conditions with the aid of expensive external inputs to control pests, drought and soil fertility. However, if ideal conditions cannot be maintained, monocropping farmers suffer wholesale crop failure, leaving them with little to harvest for either food or income.

Domain Analysis

Chevalier (2005) refers to Domain Analysis as an "all-purpose technique" because it is so versatile. It can be used in many different situations, from learning peoples' knowledge to identifying future actions based on that knowledge (Chevalier 2005: 1-2). It is the dominant research method used in the empirical research discussed herein on studying *Adivasi* farmers' knowledge regarding their unique mixed cropping farming systems.

The technique

Domain Analysis is adapted from the Repertory Grid Technique, borrowed from Personal Construct Psychology. Chevalier's additions to the Repertory Grid (henceforth shortened to rep grid) technique include applying the technique in social situations for research and development purposes (Chevalier and Buckles 2005: 40), and devising a list of ten "scenarios" (Chevalier 2005: 14-9) for effectively interpreting common analytical trends within a rep grid. A brief look at the available research on the rep grid technique can shed light on how effective it can be as a participatory tool (i.e. in Domain Analysis).

Fundamental to Personal Construct Theory (PCT) is that individuals can be likened to personal scientists, analyzing their present situation based on their interpretations of past experience, and then using the patterns, or "implicit theories", that arise to decide upon future actions (Fransella and Bannister 1977: 2-5; Shaw 1985: 26; Walton 1985: 97-100; Mosse 1994: 499; Blowers and O'Connor 1996: 2-3, 90-1; Denicolo and Pope 2001: 57-9, 119). This constant evaluation of experience shapes peoples' personal reality and how they successfully go about their daily lives while interacting in the world.

Rep grids are matrices used by researchers to facilitate reconstructing, mapping out, and understanding other peoples' *personal approximations of reality* specific to a particular topic of interest for both the researcher and the participant(s). PCT assumes that people organize the "elements" of their experiences within a topic through a finite series of "constructs" that characterize those experiences, which thus combine to characterize their reality. The rep grid, then, is a tool for understanding participants' knowledge regarding a specific aspect of their reality by analyzing their experiences (elements) of that reality according to the constructs they associate with those experiences (Jankowicz 2004: 5, 8, 12-4; Blowers and O'Connor 1996: 3). The topic of study for this research is to learn the qualities of different crops within an *Adivasi* mixed cropping system, and understand how crops contribute in different ways to achieve food and economic security for farmers.

Since we are aiming to analyze participants' experience regarding different crops, these crops are identified as the elements of the grid and are listed along the top of a matrix. In order to analyze these elements, participants need to identify constructs that can be used to qualify each (and every) element along a rating scale (discussed below). There are several ways in which constructs can be elicited from participants. The triadic technique involves isolating three elements (crops) at random and asking participants to identify what quality or characteristic makes two of them alike in relation to a key issue or problem. This must be followed by asking what the greatest contrasting quality is between the third element and the other two. The dyadic technique simply asks the participant what makes two elements different from or similar to each other. Then, the participants must choose what quality represents the greatest opposite to the original statement. In either case, a construct is identified along with its greatest opposite. Identifying the opposite quality of a construct is essential to the process.[6] This is because PCT assumes that people understand their experience in contrasts rather than in absolutes. In other words, the construct "makes me happy" can only be understood by contrasting it with its opposite, "makes me sad" (Jankowicz 2004: 11; Blowers and O'Connor 1996: 3-6; Fransella and Bannister 1977: 7). It is best to try to avoid merely negating the original statement or biasing the statement by making one pole sound good and the other bad (i.e. "makes me unhappy"). Other less structured elicitation techniques are to actively listen for peoples' constructs during informal discussions, and laddering down, which asks "why" or "how come" with respect to earlier constructs to extract more detail from participants. To learn more about construct elicitation techniques, see Jankowicz (2004: 53-64) and Chevalier (2005). The maximum number of elements (and constructs) used in a rep grid is flexible, limited only by time available for research and

6 The characteristic that makes two crops similar is the "emergent pole" and the characteristic used as a contrast is the "implicit pole". Strictly speaking, the distinctions are procedurally and analytically important, especially for a psychologist who is concerned with subtle thought processes (see Jankowicz 2004: 47-8). However, identifying emergent and implicit poles is not essential for the purposes of the research described herein.

the desired level of complexity decided upon by researchers and participants. However, a minimum of six elements and constructs is usually advisable in order to ensure the rep grid is analytically useful.

The unique feature of rep grids is that their design is heavily dependent on the input of participants, even before the exercise can start. Since the objective is to understand the participants' reality, then the constructs and elements used in the exercise should be identified by the participants themselves. This means that constructs and elements are expressed in the participants' own preferred paradigm, which helps others to better understand "the world of lived experience *from the point of view of those who lived it*" (Denicolo and Pope 2001: 60 emphasis mine; see also Jankowicz 2004: 8; Fransella and Bannister 1977: 5; Tyler 1985: 19). This allows the rep grid technique to delve deeply into participants' "complex knowledge systems without using predefined concepts" (Chevalier and Buckles 2005: 44), especially those imposed by outsiders (see also Blowers and O'Connor 1996: 16; Denicolo and Pope 2001: 64). It also follows that the research is highly relevant and personally meaningful to the participants, which is essential for maintaining their ownership of it and their interest in it.

With that said, there are circumstances in which constructs supplied by researchers/facilitators can be useful (Fransella and Bannister 1977: 19, 106). For example, researchers may supply a list of possible constructs to participants who can then decide which they agree to use in the exercise or not. They can also negotiate alterations to proposed constructs with researchers to suit their satisfaction. Supplying constructs in this way is an advantage if it makes the process easier and faster for the participants if they do not have much time for participation. Also, it allows researchers to more easily compare different rep grids. These rep grids may be elicited from the same participants but at different times, to see how knowledge changes over time, or elicited from different groups to understand how knowledge develops differently across populations (Jankowicz 2004: 56; Blowers and O'Connor 1996: 9-10; Shaw 1985: 27-32). Finally, supplying constructs is useful if researchers have specific knowledge they want to tap from the participants.

However, it is essential that significant preliminary research, groundwork, and other precautionary measures must occur so that supplied constructs are to be relevant and appropriate for the participants (Denicolo and Pope 2001: 72-3). Otherwise, the constructs may be more of a reflection of the researcher's reality and theoretical biases rather than those of the participants. In addition, the constructs may not be meaningful to participants, or may be interpreted by participants differently than how the researcher intends (Jankowicz 2004: 11-2, 27-35, 43). Such outcomes alienate participants from an integral part of the research process, deterring their further engagement and thus compromising the possible achievement of goals.

Alternatively, instead of eliciting or providing constructs, they can be negotiated between researchers and participants as "a wonderful way to engage in collaborative research" (Jankowicz 2004: 28; see also Chevalier and Buckles 2005; Fransella and Bannister 1977: 106). By discussing what constructs to use and how they should be defined, or by including both elicited and supplied constructs, the rep grid technique fulfills SAS^2 principles by allowing the objectives of more than one stakeholder group to be realized within a single rep grid exercise (see above).

Returning to the Domain Analysis rep grid process, as each construct pair is identified, participants rate all elements according to how they feel the construct pair applies to the element. As new criteria for comparison (i.e. constructs) are added, participants eventually (and perhaps subconsciously) reveal subtle paths of reasoning within the knowledge system being elicited (Chevalier 2005). Typically, a numbered scale is used to compare elements, but it is also possible to use stones or beans, cards with shades between white and black, or other objects to indicate a valuation along a scale. The size of the scale can vary depending on time available and the level of detail desired. A 2 point scale simply dichotomizes elements as belonging to either one pole or another. A 3 point scale provides a mid point rating indicating either both or neither poles apply to an element. Scales up to 5 and 7 provide room for more subtle discrimination between elements. It is possible to increase the scale further, but that may be asking people "to make finer discriminations than they can accurately express in a consistent way across the whole grid" (Jankowicz 2004: 36; see also 55). The lowest number of the rating scale represents one pole of the construct, while the highest number represents the extreme opposite pole of that construct. Since the ratings represent participants' knowledge of an issue, they should be treated as real and factual. However, this does not mean that ratings cannot be revised. As the grid exercise unfolds, participants may wish to, or agree to, revise earlier ratings in order to more appropriately reflect their knowledge (Jankowicz 2004: 48-9).

Domain Analysis outcomes: Korku case study

The method of Domain Analysis cannot easily be separated from its analysis. Therefore, I will continue to discuss it with reference to the Korku and Kuvi case studies in which I utilized the technique. Figure 1 shows what the completed, but not yet analyzed, rep grid looks like. The crops of the seed mix are listed below the grid. The constructs are listed on the sides of the grid, with one pole of the construct on the left side and its opposite on the right side. The numbers inside the grid represent participants' ratings of how constructs apply to crops. For example, the rating of a construct as it applies to maize is placed where that construct row intersects with column 3 (above maize).

Figure 1: Repertory Grid representing the Korku seed-mix system (Bulumgavhan 2004/12/07).

	1	2	3	4	5	6	7	8	
domestic 1	6	1	1	5	4	6	4	1	1 market
large yield 2	4	2	1	6	7	5	7	1	2 small yield
most healthy 3	7	1	2	5	4	3	6	1	3 least healthy
poor soil 4	1	7	4	1	6	6	5	7	4 healthy soil
early harvest 5	5	2	1	3	6	7	4	5	5 late harvest
	1	2	3	4	5	6	7	8	

8 Jawar (sorghum)
7 Urid (black gram)
6 Tur (pigeon pea)
5 Moong (green gram)
4 Tilli (sesame)
3 Makka (maize)
2 Dhan (rice)
1 Barbaty (pole bean)

The participatory analysis of rep grids can begin as soon as the construct elicitation and rating process begins. First of all, the rep grid itself only reveals information about the relationships between crops and constructs through ratings. Therefore, it is important for facilitators to listen to discussions between participants as they negotiate through the grid (Jankowicz 2004: 77). Through active listening, the facilitator can pick up on participants' implicit constructs, and then suggest to participants that these statements be transferred to the rep grid for analysis. Also, important contextual information about crops, constructs, growing conditions, *et cetera*, can be discussed, and yet not easily represented in the rep grid. Secondly, by paying attention to ratings as they are offered, the facilitator can watch for patterns, noting them to participants as they arise or once the grid is deemed sufficiently completed. These patterns then spur additional informative discussions that can further be applied back into the rep grid.

The rep grid representing the Korku seed mix, illustrated in Figure 1, is small enough that a rough analysis can be conducted with participants immediately after the completion of the exercise by comparing rating patterns in columns and rows (see Chevalier 2005; Jankowicz 2004). The shading of numbers helps to make the patterns more visual. Looking at the columns of different crops, rice, maize and sorghum are all very similarly rated and so can be considered a family. Interestingly, these three crops are all grains, so the family can be given the name "Grains" to reflect this commonality. All of the other crops have a *near* opposite rating pattern than the Grains, especially the crops pole bean and sesame. With the exception of sesame which is unique as an oil seed, all these other crops are beans and lentils, so this family can be named "Pulses." The same process can be applied to the construct ratings by looking for patterns along the rows. In general, most constructs are quite similarly rated, however, the constructs "domestic/market" and "most healthy/least healthy" appear to be the most similar. This trend within constructs emphasizes that one pole of a construct pair applies to one family of crops, and the other pole applies to the other family. Such a scenario within a rep grid is identified by Chevalier (2005: 15) as "polarization", when two families emerge with nothing in common.[7]

Next, the trends among crops and the trends among constructs can be applied to each other. The Grains family of crops, maize, rice and sorghum definitively share the characteristic of being the most healthy crops and exclusively for domestic use. Other construct patterns are less definitive, but it can be assumed that the healthy, domestically oriented Grains also yield the most – implying they are sown more – and yet also require good soils in order to succeed. Since it was already identified that the Pulses are more or less opposite to the Grains, then it can be concluded that they are relatively less healthy and relatively market oriented, and yet more tolerant of poorer soils, although it is only pole bean that is the most opposite from the Grains in this respect.

Sometimes it is desirable to have a more sophisticated, thorough and precise analysis of rep grids. A computer software package called Rep IV can give instant statistical analyses to rep grids. Of course, among people such as the Korku, who have no experience with computers, software analyses are not very "participatory" (Jankowicz 2004: 132).[8] Nonetheless, after studying Rep IV outputs, the facilitator can extrapolate the more subtle logic within participants' ratings. The facilitator can then reconvene with participants to point out to them what he or she learned. This provides a good opportunity to validate information with participants, foment further information, and again, identify

7 "Polarization" is similar to what Blowers and O'Connor (1996: 46-7) call a "tight" rep grid.

8 Chevalier (2005: 10-1) gives a mathematical equation for more accurate analyses without computer software, but in the context of this paper, this would not be appropriate to do with *Adivasi* participants.

new constructs and ratings to add to the original rep grid (Chevalier and Buckles 2005: 41; Jankowicz 2004: 72-3; Denicolo and Pope 2001: 40-1; Blowers and O'Connor 1996: 101).

The Rep IV software produces two types of analyses: Cluster Analyses, or Focus diagrams, and Principal Component Analyses, or PrinGrid diagrams. The Focus and PrinGrid diagrams for the Korku seed-mix are illustrated in Figures 2 and 3 respectively. Using mathematical equations to calculate the precise level of similarity and difference between constructs and between crops, the Focus diagram reorganizes the rep grid so that similar crops are clustered together and similar constructs are clustered together. The diagram also provides dendograms and a percentage scale, making it easily identifiable the exact degree to which crops (and likewise constructs) are similar or different to each other. In Figure 2, the Focus diagram confirms with greater precision what was initially observed in the rough analysis above. The Grains form one group on the left, and the Pulses are on the right. However, the reorganizing of the crops reveals the significant degree to which these two families are different, with the dendograms connecting the two families at only 55%. By consistently giving the Grains extreme ratings of 1 or 2, the Korku farmers have unequivocally identified them into the profile represented on the left side of the diagram and showing a minimum of 80% similarity. The Pulses crops show somewhat more variation, being at least 72% similar and with a rating range mostly between 4 and 7, but are in general opposite to the Grains (especially pole bean and sesame). By examining the dendograms on the side of the diagram, it is revealed that all of the constructs fit into a fairly singular pattern with all but one ("early harvest/late harvest") being at least 80% similar. As noted above, the "domestic/market", "most healthy/least healthy" constructs show the most similarity.

The PrinGrid diagram illustrated in Figure 3, offers additional interpretive perspectives to the Korku seed-mix rep grid. The axes that run horizontally and vertically through the centre of this diagram represent the two Principal Components of the Korku rep grid ratings. In short, Rep IV software identifies the two rating patterns, or principal components, that account for the widest variability and gives them a percentage value based upon how much of the total variance in the rep grid that they represent. The complexity of this process is explained thoroughly by Jankowicz (2004: 127-38) and Blowers and O'Connor (1996: 107-9). Suffice to say that the greater the percentage variance that the Principal Components add up to the more it can be assumed that interpretations drawn from the PrinGrid diagram are an accurate reflection of what the participants have stated through their ratings. With specific reference to the PrinGrid diagram in Figure 3, the first component (horizontal axis) is 62.7% of total variance, and the second component is 25.2% of total variance. Added together, the Principal Components account for 87.9% of total variance, making this diagram highly representative of the Korku participants' knowledge of their seed-mix as detailed in the rep grid.

Figure 2: Rep IV analysis of Korku seed-mix repertory grid, Focus diagram (Bulumgavhan 2004/12/07).

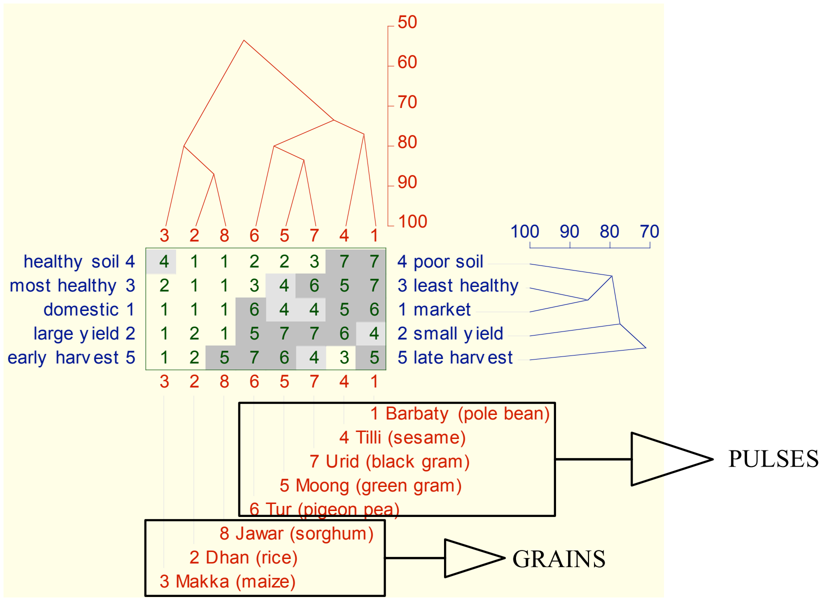
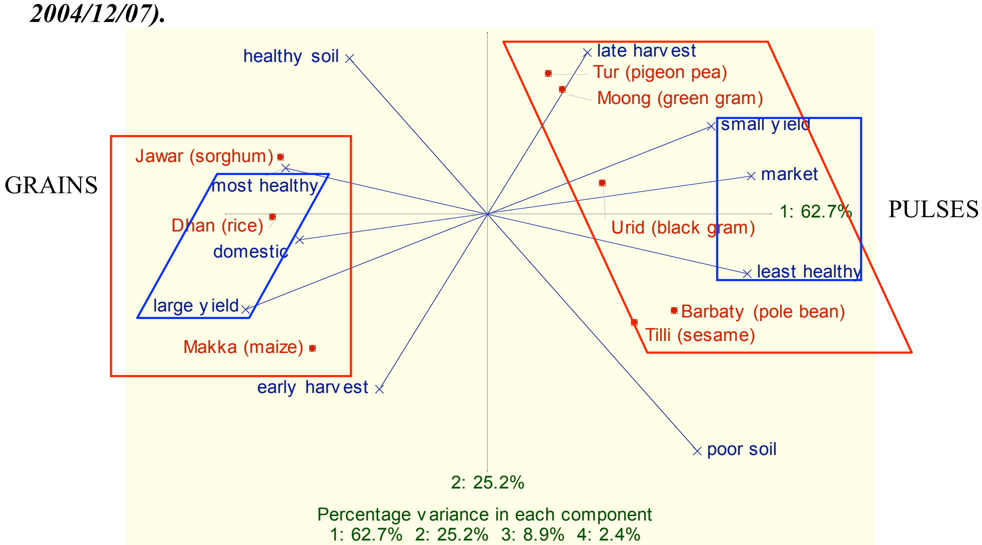


Figure 3: Rep IV analysis of Korku seed-mix repertory grid, PrinGrid diagram (Bulumgavhan 2004/12/07).



Further interpretations of the PrinGrid diagram depend upon the spatial location of crops and constructs to each other and to the Principal Components. The diagram in Figure 3 again reaffirms the statements already made, that the Korku seed-mix is a polarized agricultural system. This is evident because the Grains family crops and the Pulses family crops (plotted in red) are clearly located spatially distant from each other. The three Grains crops are far to the left side of the PrinGrid diagram, revealing their extreme ratings which characterize them according to the constructs plotted (in blue) in the same immediate area of the diagram. The Pulses, while on the opposite side of the diagram, and thus having generally opposing characteristics to the Grains, are nonetheless not as extremely similarly rated. This is apparent due to their somewhat more dispersed positioning throughout the right side of the diagram. Turning to the constructs, once again the relationship between large yields of healthy crops being reserved for domestic use is emphasized, while less is harvested of less healthy crops which are more intended for market use. The near proximity of the constructs to the very representative first principal component (horizontal axis) further strengthens this logic. On the other hand, the constructs "healthy soil/poor soil" and "early harvest/late harvest" are less important for defining the two crop families since they are distantly plotted from either of the principal components.

This analysis is not merely a listing of crops and their characteristics. The similarity between construct characteristics and how they profile certain crops allows for interpretive analysis of the Korku seed-mix system. When different constructs have similar ratings, this suggests a relationship between them, such as one may be a cause for the other, or one may always be present when the other is. Since Grain crops are intended for domestic use only, they are obviously subsistence crops. Furthermore, Korku farmers obviously prioritize self-reliance from a subsistence economy since the Grain crops are also the most healthy crops, the most harvested crops, and the earliest crops to ensure that new food is available when last year's stores run out. On the other hand, the Pulses crops are less healthy (although none are *un*healthy) and thus are instead valued as cash crops to be sold at the market. This facet of Korku economy is important, but secondary since Pulses make up a smaller portion of the harvest. Nonetheless, Pulses do make some contribution to subsistence since none are exclusively for market. In addition, Pulses crops tend to tolerate at least slightly poorer soils than Grains, making them economically important not only as cash crops, but also subsistence crops if poor soils result in a poor harvest of Grain crops.

In general, Grains and Pulses do not have any shared characteristics with each other – they are mutually exclusive – but all crops within each family share characteristics rather closely. While it sounds advantageous to have several crops with one set of characteristics, and another set of crops with the opposite characteristics, especially in terms of diversifying the economy, this does not mean that the Korku seed-mix is diverse. On the contrary, the polarization between the two crop families indicates only a limited amount of diversity. "Polarization" means that despite the presence of eight crops in the Korku seed-mix system, these crops fall into only two families with opposing profiles (Chevalier 2005: 15). This strains the resilience of the Korku system due to a reliance on an "either/or" scenario. Ecologically, opposing profiles mean that all crops in one family will thrive under one set of conditions and all of the crops from the other family will thrive in the opposite set of conditions. Since it is unlikely that both sets of conditions can be met at one time, only one crop family will thrive. In the unfortunate circumstance when neither set of conditions arise, then the whole system threatens to collapse.

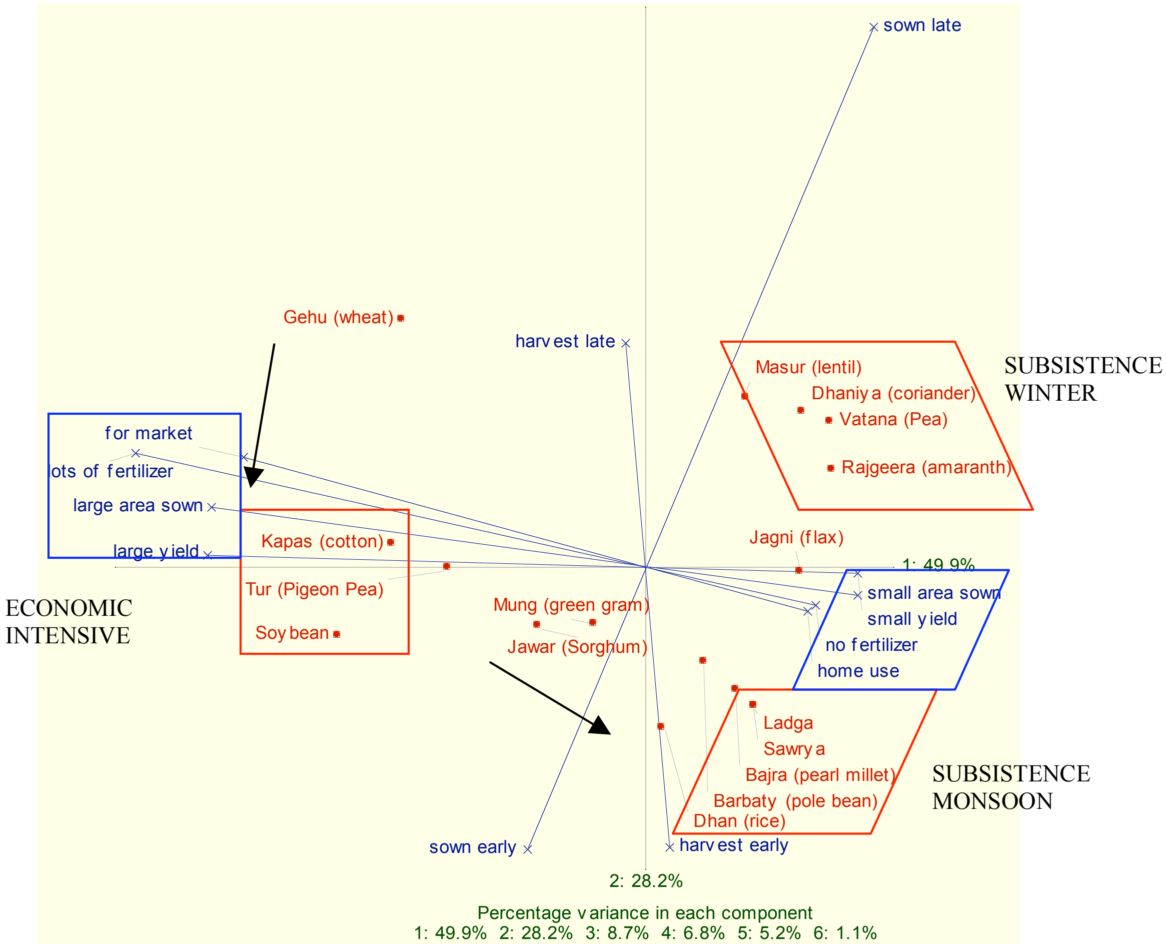
Thankfully, the Korku seed-mix is not as polarized as it could be. A few exceptions within crop profiles inserts at least a small amount of diversity into the system. In terms of Grains, sorghum is harvested a little later in the season, ensuring some fresh subsistence food for the latter part of the year. Secondly, maize tolerates relatively poor soils, ensuring Korku farmers some subsistence grains should the soil not support sorghum and rice. As for the Pulses, there is some general variability between crops compared to the Grains. Most notably, sesame is a relatively early harvested crop, ensuring Korku farmers that their inflow of cash is more spread out over the season.

As mentioned earlier, more than a dozen other crops are sown as single stands in individual small plots throughout Korku farms. These crops are kept separate from the seed-mix for several reasons, one being that they have specific qualities that require them to be sown where the growing conditions are most appropriate. In addition, being sown as single stands helps to increase the yield of those crops as well as those in the seed-mix since it prevents the seed-mix from becoming so widely diversified that crops negatively impact each other through competition. Another reason for sowing single stands, is that some crops are grown exclusively for market purposes, and so the most efficient way of maximizing yield, and thus income, is sought out.[9]

While it is easy to assume that when these additional crops are considered, the Korku mixed cropping system must become more diverse, rep grid analyses indicate that this in fact not the case. Figure 4 shows a PrinGrid analysis of a rep grid that includes a random selection of sixteen Korku crops, from both the seed-mix as well as those sown as single stands. The diagram reveals an equally polarized system as that identified within the seed-mix alone. The right side of the diagram is identified with the Subsistence family of crops. These are all crops that are primarily used within the home, are sown in a small area, are harvested in small amounts and are given no fertilizer to help boost production. The only element of diversity within this family regards sowing and harvesting times. One sub-group of these crops is sown at the beginning of the monsoon rains. After they are harvested, the same land is used for the other sub-group of crops, which prefer the cool, dry climate of the winter. On the one hand this is an important distinction, since it ensures that a wide variety of subsistence crops are made available throughout the year. The difference in sowing times also implies that monsoon crops require more rain and hot weather to thrive, while winter crops will succeed with little rain and cool – possibly frosty – nights. However, the difference between growing conditions does not necessarily offer resilience to the Korku system since a poor monsoon season will result in poor harvests for monsoon crops, and winter crops will not be in the field at that time to take advantage of the climatic anomaly. Likewise, a poor monsoon will mean that winter crops will also do poorly, since there will not even be the little amount of moisture in the soil required by them to survive.

9 This may include the use of hybrid High Yielding Varieties and urea fertilizer, especially for cotton and soybeans (see below).

__Figure 4: Rep IV analysis of random selection of Korku crops, PrinGrid diagram (Takarkheda 2004/12/06).__



On the left side of the diagram, with the opposite profile, is the Economic Intensive family of crops. They are sown in large amounts, and with the help of chemical (urea) fertilizer, farmers reap large harvests with the intention of turning financial profits from the land. Subsistence crops do not receive fertilizer in part because they are more tolerant of poor soils, but also because farmers are weary of the impacts that chemicals would have on their health and the health of their livestock.[10] However, since Economic Intensive crops are not used much in the home, farmers are more motivated to maximize their yields with chemical fertilizer (Shenware 2004/12/11). Discussions with Korku farmers outside of this Domain Analysis exercise revealed that Economic Intensive crops also require more water and better soil than Subsistence crops. This means that Economic Intensive crops benefit farmers only by allowing themselves to become dependent on expensive external inputs such as irrigation and chemical fertilizer to stabilize unpredictable conditions. For this reason, no Korku farmer would consider breaking from

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[10] Additionally, subsistence fields do not receive chemicals so that farmers can harvest several uncultivated crops which provide additional forage, food, fibre, income.

the seed-mix tradition and converting their entire farm to cash cropping.

A few crops escape such a definitive profiling into either the Subsistence family or the Economic Intensive family due to minor individual idiosyncrasies. For example, sorghum is a subsistence crop, but is plotted between the two families because, as the Korku people's staple grain, it is sown more than other subsistence crops. Likewise, green gram is plotted near sorghum because it is valued both for home use and market use. Finally, wheat is separated from other Economic crops only because it is sown during the winter season, and flax is between the two Subsistence sub-families because it is sown halfway through the monsoon, and harvested halfway through the winter.

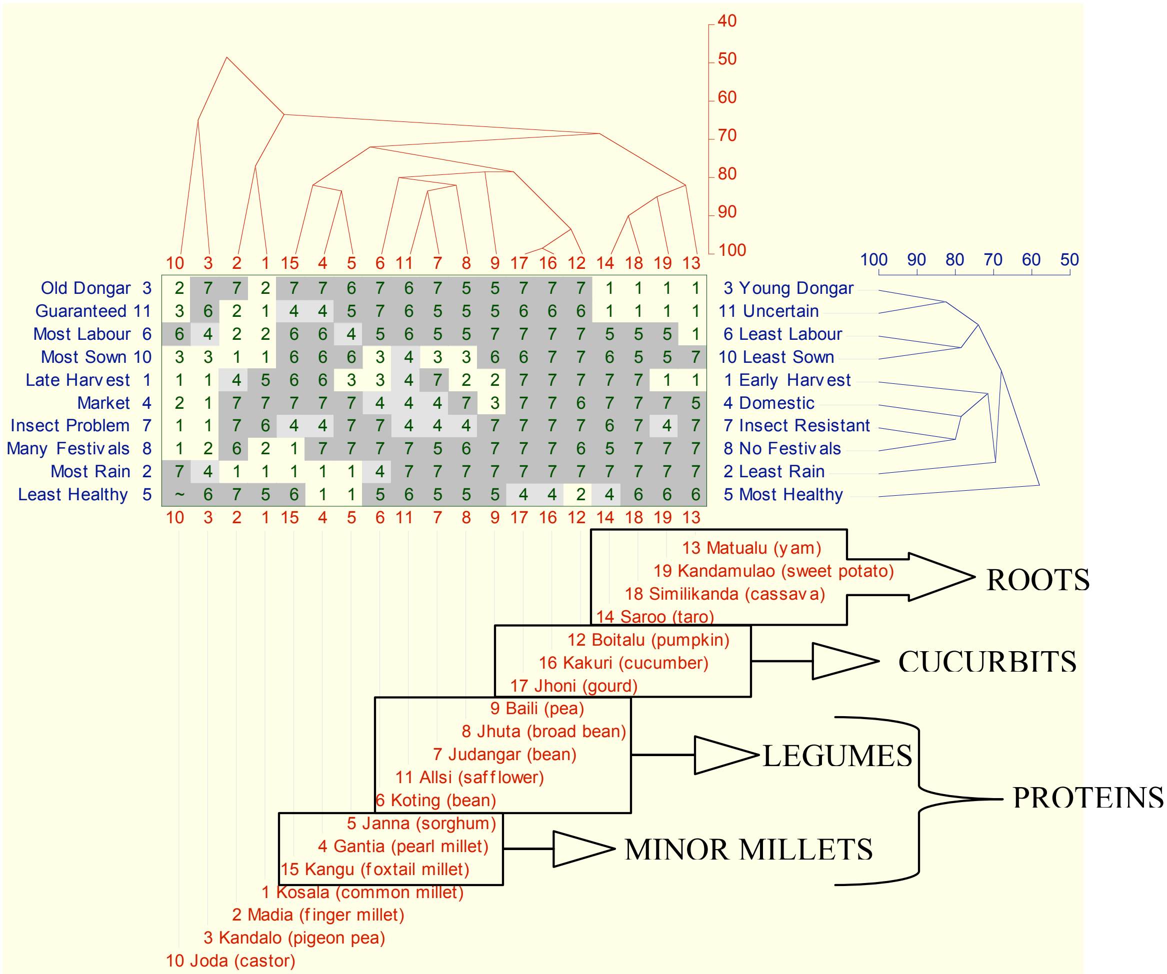
Despite bringing the total number of crops to twenty-two, it is dubious whether the single stand crops make a significant contribution to actual on-farm diversity. As a result, the Korku mixed cropping system as a whole is only moderately resilient to unpredictable ecological conditions. However, the inclusion of the Economic Intensive crops does improve Korku farmers' economic diversity. When all crops are considered, market and subsistence economies are weighted about equally in importance by Korku farmers. This must be compared with mainstream farmers, not far from the Korku, who rely almost exclusively on a few large stands of cash crops. Unlike the Korku, these farmers are resilient neither to ecological changes, nor to economic changes.

Domain Analysis outcomes: Kuvi case study

Instead of identifying just two crop families with opposing profiles, the Domain Analysis exercises representing the Kuvi seed-mix have identified a much more diverse mixed cropping system. The Kuvi seed-mix is more appropriately described as "fragmented" (Chevalier 2005: 15), embodying several different families of crops, the members of each being only loosely affiliated.[11] In other words, rather than each crop falling into one of two mutually exclusive profiles (as with the Korku mixed cropping system), almost each Kuvi crop has a unique profile. This profile may exhibit some characteristics in common with another crop, but also notable differences from that same crop. The result is that rarely can more than one crop be described in the same way as any other crop. Therefore, Kuvi system can be described as diverse and thus also resilient. This is important for Kuvi farmers because their socio-cultural and geo-political situation means that they cannot augment yields with external inputs of fertilizer and water, nor can they grow crops valued on the national market, nor can they even easily access markets for generating significant amounts of income.

[11] "Fragmentation" is similar to what Blowers and O'Connor (1996: 46-7) call a "loose" rep grid.

Figure 5: Rep IV analysis of Kuvi seed-mix rep grid, Focus diagram (Katragumma 2005/01/04).



The trend toward a fragmented mixed cropping system is illustrated in the Rep IV analyses of Kuvi farmer's rep grid about their seed-mix (Figures 5 and 6).[12] Dendograms in the Focus diagram (Figure 5) identify four possible crop families, while several other crops elude profiling altogether. Likewise, trends among constructs are equally as elusive, with several constructs having little relationship to any others, while a few manage to pair up to make general statements with. For example, crops that continue to thrive in an “Old Dongar” (meaning a field in its third year of cultivation without fallowing) are likely to be crops “Guaranteed” to harvest under any circumstances. Likewise, any crops that yield well only in a newly established, or “Young Dongar”, are also crops that are generally most uncertain to yield well in a given year. Another trend is that crops known to have an “insect problem” are also crops that are involved in “many festivals”, whereas crops that are insect resistant do not receive attention at festivals. With so many different family profiles, polarization cannot be a possible scenario. No crop families share the exact same profile, nor the exact opposite profile of another crop family.

The most notable Kuvi crop family is the Cucurbits, cucumber, gourd and

[12] Given the large number of crops and constructs in this rep grid, doing a rough analysis without the software is not feasible.

pumpkin. All three of these crops have almost identical and extreme ratings (6 and 7), revealing a family profile that coincides exactly with the constructs listed on the left side of the Focus diagram (Figure 5). The only moderate quality of these crops is with reference to their general healthiness. Otherwise, while Cucurbits are among the earliest foods available, and easy to grow due to drought and insect resistance, they are also very uncertain to yield as the soil fertility of an "Old Dongar" decreases.

The Roots are another family within the Kuvi seed-mix. These are very important crops because they are rated as being both durable against all sorts of ecological adversity as well as being healthy crops valued both at home and at the market. Although it seems strange the the Roots are relatively less sown than most other crops, this is in part because they are so productive and in part because they are so nutritionally dense that only a small amount is needed (Tunia and Mandro 2005/01/16). It is interesting to note, that although the Roots appear to be a definitive family, each of the crops within this family have one or two unique qualities that differentiate it from the other crops. For example, taro is less healthy than the others, sweet potato has more problems with insects, and yams are labour intensive to harvest.

The Pulses family of crops occupies the central area of the Focus diagram in Figure 5. This means that Kuvi farmers have rated these crops relatively moderately compared to the Roots and the Cucurbits. As a result, the profile for Pulses is rather vague. They are not the healthiest crops, nor are they the least healthy; some of their harvest is taken to market, but some is also reserved for domestic/subsistence purposes; they do not yield as well in the tired soil of an "Old Dongar", but they will not fail completely. In general there is a lot of variation within the Pulses family, with ratings ranging from 3 to 7 for some constructs. The only definitive statement about the Pulses is that, like the Cucurbits and the Roots, they require little rain in order to thrive.

The Minor Millets are also a difficult family to profile using universals, but this is not only because they have moderate ratings, but also because few constructs apply to all three crops in this family. For example, sorghum and pearl millet are identified as among the least healthy crops (1), yet foxtail millet is considered very healthy (6). The only absolute characteristics of all Minor Millets are that they are reserved exclusively for domestic use and they require abundant monsoon rains.[13]

The remaining four crops, castor, finger millet, common millet and pigeon pea, are unique and cannot be included in any other crop family. In short, each of these four crops may have characteristics shared with each other or with one or more of the other crop families, but their overall profile is unique. More specifically, finger millet and common millet are obviously the most important staple crops since they are by far the most sown crops and are exclusively for domestic use. Castor and pigeon pea are unique because they are important for festivals, they have notable insect problems and they are the most market oriented of the Kuvi crops.

So far, in discussing the Kuvi seed-mix, I have not brought attention to the PrinGrid analysis. However, this diagram is important to the analysis of the Kuvi seed-mix system. At first it appears that the PrinGrid diagram in Figure 6 merely confirms what has been drawn from the Focus diagram in Figure 5. For example the Roots and Cucurbits are plotted as distinct families, and the Minor Millets and Pulses are identified

[13] This latter point is not necessarily a weakness since sometimes the rains are so heavy that the Pulses do poorly, but this is ideal for the Minor Millets.

as being a single, albeit loosely affiliated family. The PrinGrid diagram also seems to draw stronger relationships among construct groups, such as that domestic crops are not used for festivals, and they are sown less, perhaps because they are insect resistant. A closer inspection of the diagram in fact reveals that these relationships, either between crops, between constructs or between crops and constructs, are not as significant as they appear. Looking at the Principal Components of this diagram, it can be seen that they account for only 51.1% of the total variance within the Kuvi farmers' rating patterns in the original rep grid. In fact, the Rep IV software has identified another seven different rating patterns, some of which account for substantial degrees of variance (listed at the bottom of the diagram). Using any of these other "Components" to analyze the Kuvi rep grid, such as the third and forth components illustrated in Figure 7, the new PrinGrid diagram appears vastly different. The original crop families and construct relationships are broken apart and reorganized quite differently. This means that the original PrinGrid diagram in Figure 6 does not well represent the Kuvi rep grid. Furthermore, it means that the identification of any crop families and construct relationships is tenuous and the Kuvi seed-mix has an even greater tendency toward fragmentation than originally noted, with all crops being more or less unique. Reviewing the Focus diagram, for all crop families there is at least one instance of a crop within each family having at least one or more characteristics that are unique from the other crops within that family.

Again, the above is not just a listing of crops and their qualities. There is something to be said about the Kuvi seed-mix system and how it contributes to the food security of these remote people. As revealed in the analysis of the Korku mixed cropping system, it is not enough to have many crops. In order to have a truly diverse mixed cropping system, there must be varying characteristics between crops as well as the knowledge about the different characteristics on the part of the farmers. The Domain Analysis technique can uncover the subtle knowledge of farmers regarding the specific advantages, and also the imperfections, of all crops. When different crops with their qualities are combined, all qualities are embodied within the growing area, leaving farmers certain that they will always have several crops to harvest for their food security, regardless of unpredictable natural events.

Agronomists say such a diverse system works against itself as competition between so many different crops reduces yields. They suggest Kuvi farmers focus on a main staple, supported by small amounts of a few other important crops. These should be sown as single stands to improve yields, and in strips following the contour of the land to curb erosion. The inevitable surplus harvest could be sold at market so farmers can purchase the rest of their nutritional and other needs (Mangaraj and Allim 2005/01/15; Patra 2005/01/16; Mahapatra 2005/01/16). However, few if any of the many crops that would disappear from Kuvi farms can be purchased, or even substituted for, at any markets.[14]

14 A separate social concern is that Kuvi people, being unused to engaging in the market economy, will be cheated and exploited by savvy traders at the market and will be convinced to purchase unnecessary commodities.

Figure6: Rep IV analysis of Kuvi seed-mix rep grid, PrinGrid diagram (Katragumma 2005/01/04).

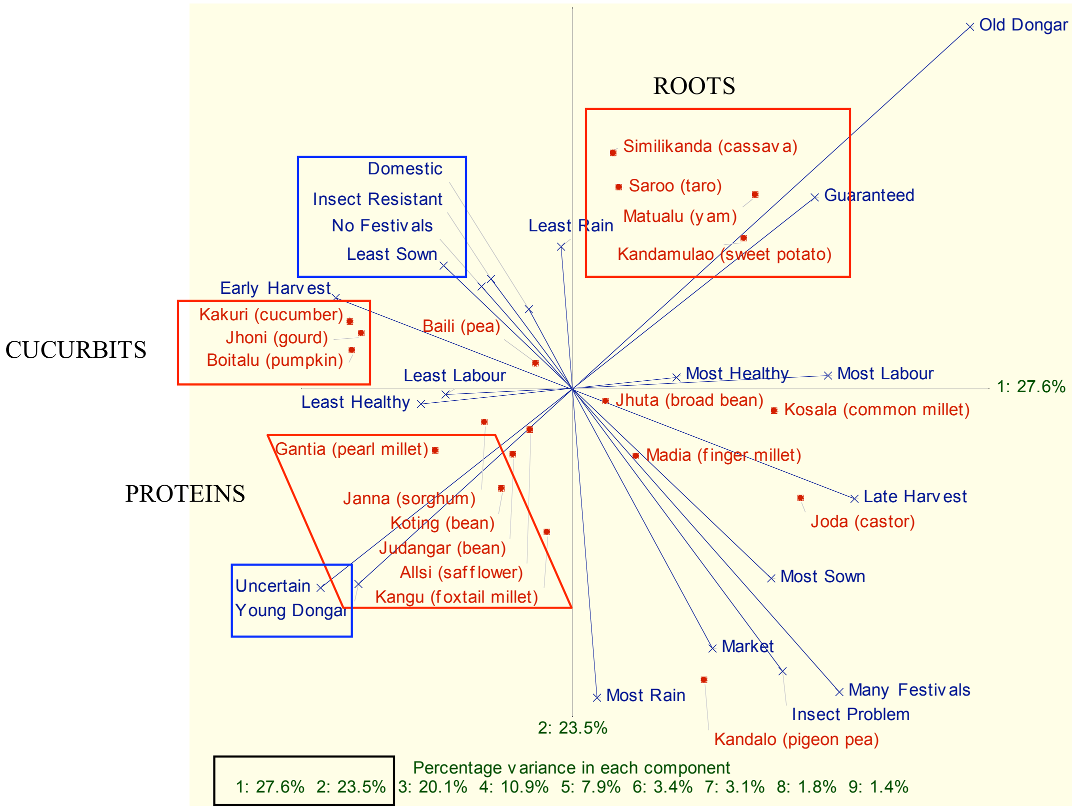
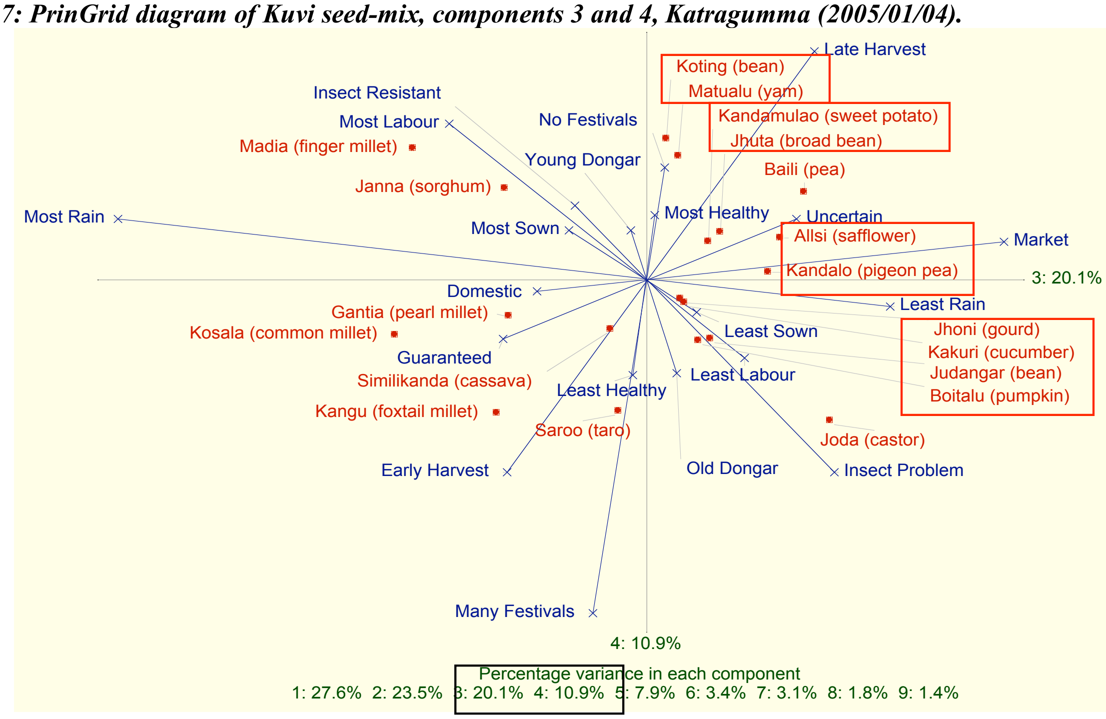


Figure 7: PrinGrid diagram of Kuvi seed-mix, components 3 and 4, Katragumma (2005/01/04).



Given the Kuvi farmers' analysis of their seed-mix system during a Domain Analysis exercise, it is difficult to imagine that they can give up most of their crops to focus on just a select few. Diversity in the Kuvi mixed cropping system is to ensure a secure yield of many crops rather than maximizing the yield of just a few crops, which would leave people vulnerable to both market and natural processes. The Kuvi farmers shatter the “misleading notion that agricultural communities are based solely on the production and consumption of a few 'staple' foods” (Mazhar and Buckles 2000: 3). Admittedly, according to the Domain Analysis of the Kuvi seed-mix, a few “staple” crops are relied upon more heavily than other crops. Still, every other crop has specific inherent values for contributing to Kuvi livelihood, whether socially, economically, or ecologically. Although subsistence appears to be a priority for Kuvi farmers, they are not completely isolated from market transactions. Some of the harvest is traded at the market so that Kuvi families can acquire the few needs that they do not produce themselves, such as cloth, cooking items, and a favourite food, dried fish. Likewise, the crops castor, pigeon pea, common millet and finger millet play an important role in Kuvi festivals.

In addition, from a Kuvi farmer's perspective, the proposal of agronomists would drastically increase farmers' labour inputs (sowing, weeding, *etc*), acting to actually reduce efficiency at the end of the day. More telling, this farmer said that it might be possible to adopt the agronomists' advice, but it would mean abandoning the traditions of their ancestors (Tunia 2005/01/05). Ultimately, it is the traditions around living in the mountains, practicing shifting cultivation and sowing a seed-mix with specific traditional crops that shapes the cultural identity of Kuvi people (Sathapathy 2005/01/11; Soreng 2001: 44, 50-4; Pramanik 2000: 125; Nayak 2000: 10; Nayak et al 1999: 59-61; Bahura 1992: 15-6; Daspatnaik 1984: 26, 28).

Reflecting on Domain Analysis Research

Problems experienced

Unfortunately, the analyses and interpretations I make about the Korku and Kuvi Domain Analysis exercises must be viewed with caution. In several ways, the ideals of “participation” were not achieved during the research period, resulting in several consequences affecting the integrity of the research. Many of the shortfalls to this research echo the criticisms of the participatory precursors to SAS [2]. However, the problems affecting the research are not associated with the Domain Analysis methodology *per se*, but with the social contexts in which participatory research was being initiated and the skill of the researcher in effectively facilitating participatory exercises in the appropriate way within those contexts. Related to both of these factors is the necessity that researchers build rapport and understanding with communities through long term immersion and commitment to the people and their society.

A notable shortcoming of the research is that “participation” from farmers involved them in merely rating their crops according to mostly predefined constructs. At this, the participating farmers were quite adept. They confidently and quickly rated each crop according to the construct being considered. When a new construct was introduced, they would then rate all of the crops again. It was obvious that the participants easily understood the meaning of their ratings. For example, when I questioned them about the implications of certain ratings, participants usually confirmed that the ratings were correct. On occasion, as new ratings were laid down, they would make adjustments to earlier ratings, sometimes even on their own initiative.

However, farmers’ actual involvement in identifying constructs and conducting analyses and interpretations of the rep grids was significantly lacking. The constructs were mostly provided by me, as the facilitator. I attempted to elicit constructs using the triadic method, asking participants to identify what quality made two crops similar and a third different, but participants were silent. I alluded to the types of qualities that could be considered, such as ecological requirements or social values. They seemed confused and unsure what I was asking them to do. I then tried to simplify my approach using the dyadic method, but had no greater success. Eventually, I was asked to suggest the constructs. I complied to move the process along, and with the hopes that participants would catch on and begin to suggest their own constructs, but they never did. This scenario occurred with both Korku and the Kuvi farmers.

The farmers' confusion speaks to a common assumption made by researchers that participatory technique are inherently easier for people to engage with than more conventional interview styles. Firstly, participatory exercises are actually very formal and very public events. By virtue of being public and formal, significant sections of the population, such as women or other marginalized groups, can be excluded from participating in research exercises (Chevalier and Buckles 2005; Li 2002; Kapoor 2002: 105-6; Campbell 2001: 382; Mosse 1998: 16-7; 1994: 507-16).[15] The people who do participate will have a particular way in which they want to portray their community to outsiders (Jankowicz 2004: 193). Secondly, participatory techniques force people to learn new ways of communicating. Since not everyone has "the inherent ability for visual literacy" (Mosse 1994: 517) participatory techniques can be confusing and difficult for people (see also Mosse 1998: 17; Opp 1998: 78, 139; Campbell 2001: 382). For people not accustomed to participatory techniques, the logic appears abstract, the goals are not immediately apparent and the visual outputs "generate a greater sense of mystification than conventional research" (Mosse 1994: 505; see also Jankowicz 2004: 33-5, 44; Campbell 2001: 383; Pratt 2001: 14, 19, 21; Sillitoe 1998: 238). The amount of effort required of farmers to learn how to participate may be enough to dissuade them from bothering.

Farmers' disinterest in the Domain Analysis method may have reflected a disinterest in the research in general and my motivations for initiating it. These are remote farmers, and although they are working on agricultural biodiversity issues with local non-governmental organizations (NGO), they may not see their mixed cropping systems as unique or important. My arrival to further pursue research on their mixed cropping systems using an unfamiliar research technique may not have been considered as valuable to them as it was to me.

Participants' disinterest may also stem from an inherent distrust of outsider researchers. The Kuvi and Korku people are not alone in experiencing research projects introduced by outsiders to foster development initiatives that would end up irrecoverably damaging their communities (for example, see Jankowicz 2004: 193; Pratt 2001: 14; Shiva 2000; Mosse 1994; Baviskar 1995). Using participatory methods can appear simply as a more sophisticated form of exploitation on the part of development agencies. Having "implications for the future of the community" (Mosse 1994: 509), people may thus choose to limit the quantity and the quality of information they offer if they fear it will be used against them.

15 Ironically, the people who are excluded from contributing their knowledge tend to be the same people for who the research is intended to benefit the most (Mosse 1994).

Unfortunately, by providing the constructs during exercises, I further perpetuated these problems. This is because the constructs I could suggest were ones that were of interest to me and not necessarily important to participants (Mosse 1994: 517). My Domain Analysis constructs were invariably descriptive and classificatory, typical of the Western positivist paradigm which I am influenced by, but was not likely a paradigm shared or understood by *Adivasi* participants. Gradually it would appear that the research was more and more "mine" and that I was the "expert". The addition of "core" constructs with intimate meaning to the participants would not only produce better, more accurate rep grids, but also heighten the invested interest of the participants (Chevalier and Buckles 2005: 41; Jankowicz 2004: 85-8; Sillitoe 1998: 239). Without such constructs, the participants became increasingly alienated from the increasingly irrelevant exercises.

The alienating of participants snowballed through the analysis and interpretation stages of research as well. Again, due to their ambivalence toward the research, farmers were not interested in committing the time to reconvene and discuss analyses and interpretations of Domain Analysis exercises. Instead, the analyses and interpretations were also performed by me, using Rep IV software, a technology not accessible to *Adivasi* farmers. Furthermore, much of this aspect of the research was eventually performed in Canada rather than in the *Adivasi* communities who supplied the information. As a result, the interpretations and conclusions that I draw are extrapolated, in isolation from participants' raw data. While I believe I have well represented the Kuvi and Korku participants, it is possible that my interpretations and conclusions would not be recognized by them as being their knowledge (Chevalier 2005: 13; Jankowicz 2004: 71-4, 132-36; Denicolo and Pope 2001: 90; Pratt 2001: 19; Blowers and O'Connor 1996: 107-19). Nonetheless, the entire research process would only be "participatory" in a merely superficial sense. As much as I wanted this research to belong to all who were involved, the farmers were given many reasons to believe that the research was "mine", from the research idea, to the initiation of exercises, on to their eventual interpretation.

Aware of what was happening to the research process, I made concerted efforts to make the research as meaningful as possible to participants so that they would keep participating. Firstly, with each supplied construct, I asked participants if they understood it and if they felt it was relevant to the issue. This also gave participants an opportunity to adjust the supplied constructs and make them more appropriate. I also tried to draw new construct suggestions by actively listening to and drawing from sideline discussions and comments by participants during exercises, as well as from separate informal interviews. These sideline discussions were also very effective for eliciting knowledge that would not be represented in the rep grids (Chevalier 2005: 9; Jankowicz 2004: 77-80). For example, Korku people will not eat crops grown with fertilizers because they believe the chemicals can cause illness, and the Kuvi farmers claim seed-mixing is necessary because certain crops can only produce well if they are growing next to certain other crops. In terms of analyzing grids, I tried to keep participants engaged by noting patterns in the rep grids as they unfolded. I publicly noted to both Korku and Kuvi participants that they consistently rated domestic crops as also being the most healthy crops, and described the possible impacts of this correlation. While this correlation ultimately did not surprise the participants, and was even confirmed as an accurate observation, they had not previously realized that the correlation existed.

Otherwise, the most I could do was take advantage of the benefits with supplying constructs and conducting my own analyses and interpretations. By supplying constructs, I was able to get a rep grid that was substantial enough to be analytically useful, but within a short frame of time. This was crucial given my concern that farmers were not interested, and might leave the exercise at any moment. Another benefit of supplying constructs is that rep grids with the same or similar constructs can more easily be compared with each other. This is useful for validating the data in one rep grid by comparing it with another. Furthermore, comparing rep grids can identify how participants' knowledge may change over time or how different groups of participants in the same situation may have different knowledge and understanding of that situation (Jankowicz 2004: 56). For example, Korku farmers in Takarkheda village and Bulumgavhan village disagreed regarding the quality of soil that seed-mix crops require. It could be that farmers in Takarkheda consider seed-mix crops as tolerant of poor soil because in their village soybeans and cotton are important crops and these require very good soil. In Bulumgavhan, soybean and cotton are rarely grown, so farmers in this village do not have the same frame of reference to compare their seed-mix crops to.

Solutions are in the writing

There are two integral aspects of participatory research and SAS techniques in particular that can help overcome the above mentioned shortfalls of my research. One is to invest in building rapport with farmers before jumping into participatory exercises. The other is to utilize the flexibility scales built into Domain Analysis and other SAS techniques depending on the needs and abilities of the participants. These two factors are also inter-related in that knowing the right level of complexity to use for participatory research significantly depends on an intimate knowledge of the people who are potential participants. As the research practitioner, my experience and skill with the Domain Analysis technique was also a factor affecting whether I employed it at the appropriate level.

Although participatory methods are touted as being quick ways to gather a lot of information (Jankowicz 2004: 15-6, 197), this should not imply that researchers can expect to enter a community, learn all they need to know, and then leave again, all over a short period. Participatory techniques do not replace the need to spend time building rapport and trust with potential participants before initiating formal research exercises (Pratt 2001: 32; Colverson 1999: 167). This time also allows researchers the opportunity to build their own understanding of local conditions, which help them to analyze social differences, recruit participants and facilitate exercises (Pratt 2001: 38; Mosse 1994). During this time, researchers also learn what the priority issues are for potential participants. When the time comes for participatory exercises, the researcher can start with an engaging and meaningful question for participants, thus fostering genuinely "participatory" research and avoiding ambivalence, superficiality and even adversity. The benefit for the participants is that they become familiar, and even interested, with the researcher and the research being pursued.

In a discussion of SAS techniques, the issue of flexibility must be raised. During the preliminary research period of building rapport with local people, SAS practitioners can engage people in several simpler SAS techniques before introducing them to the more complex Domain Analysis technique. This process not only "prepares" (White 1999: 47) people for more involved participatory exercises, but also each simple exercise sequentially feeds information into the next. Eventually, the researcher will acquire the confidence of the people and the necessary social knowledge to initiate the Domain Analysis under the most appropriate pretences.

This knowledge also helps practitioners to apply a sliding rule principle to simplify or advance any SAS technique between “analytical reasoning” and “narrative account” according to specific socio-cultural situations and research objectives (Chevalier and Buckles 2005: 38). For example, the Domain Analysis process can be simplified in many different ways. Of course, by supplying constructs for Domain Analysis exercises I was able to simplify the entire process. However, there are more effective ways of adjusting the Domain Analysis process that will have less negative impact on the outcomes of the exercise than supplying prescribed constructs. Firstly, rep grids can be elicited from small groups of just a few people, from members of a single family, or even from individuals in order to reduce the public formality of the process as well as social pressures to either conform or restrict participation.

Secondly, there are several different ways of eliciting constructs for rep grids (Jankowicz 2004: 52-69; Chevalier 2005). The triadic and dyadic methods I used to initiate Domain Analysis exercises are perhaps the most difficult methods, and thus were inappropriate for that situation. In response, I intuitively adopted the much simpler elicitation method of “actively listening” for participants’ constructs revealed implicitly during informal discussions. I could then suggest these constructs be added to the rep grids. There are two other elicitation techniques that would have been effective, but I was not aware of them until after finishing the fieldwork period. The first is “laddering down”, which I could have used to deconstruct the vague and descriptive constructs supplied by me to uncover deeper “core” constructs of the participants. Laddering down asks participants to specify how is it that a crop more or less healthy than others, and what makes a crop more or less drought resistant than other crops. The other elicitation technique is to add a hypothetical “ideal element” into the list of other elements (Jankowicz 2004: 99). Asking farmers what are the characteristics of the “ideal crop” would elicit responses that could be used as constructs in a rep grid. Including the ideal crop into rep grid analyses would add an interesting comparative element, identifying what real crops are most valued and for what reasons.

Finally, a rep grid does not actually need to be elicited at all for a Domain Analysis exercise to be useful. One of my faults, common among practitioners of participatory methods, was the belief that success is evaluated through the possession of completed visual outputs. As mentioned early on in this paper regarding other participatory systems, visualizations may mystify and confuse participants. Practitioners of Domain Analysis should be reminded that “the grid becomes a specialized form of dialogue – a technique for directing attention during a social encounter” (Jankowicz 2004: 77; see also Denicolo and Pope 2001: 89-90; Easterby-Smith 1981: 16-7; Fransella and Bannister 1977: 4; Mosse 1994: 517). There does not need to be a completed matrix in order for the exercise to be useful. From my observations, Korku and Kuvi participants hardly even looked at the rep grid as it unfolded, even as I pointed out relationships visible to me, and yet they easily followed the rep grid process as a verbal exercise. Obviously, eliciting a visual rep grid was more a concern for me than it was for participants. Therefore, instead I should have conducted informal group discussions generally guided by my knowledge of the Domain Analysis process, but without actually

building a rep grid. I could have elicited similar knowledge from participants, but in a less structured and more "narrative" style.
If necessary, the knowledge recorded from the discussions can be plugged into an unofficial rep grid format for additional analytical, comparative and documentary purposes (Jankowicz 2004: 77).

In many cases, researchers need only look to themselves to correct many of the shortcomings that arise during participatory research. Building rapport and confidence with local people, and the skills necessary to effectively employ participatory techniques at the right level, takes time, practice and experience (Jankowicz 2004: 15; Pratt 2001: 51; Colverson 1999: 167). Unlike other participatory systems (PRA), many of the other challenges faced by me, and common to participatory research in general, have solutions that are written directly into SAS theoretical foundations (Chevalier and Buckles 2005) methodological practices. Furthermore, the flexibility that enables a single Domain Analysis exercise to move back and forth between "analytical reasoning and narrative account" is a significant advantage with all SAS ^{2} techniques. The result is not only that research can be conducted in a way that is most appropriate for whoever is participating, but also that knowledge can be transferred across disciplinary boundaries, helping both the participants and the researchers to meet their own specific research goals (Chevalier and Buckles 2005; Jankowicz 2004: 74-7).

Conclusions

Citing many of the shortfalls of other participatory systems, the Social Analysis System ^{2} introduces many new "tools and techniques for collaborative research and action" (Chevalier and Buckles 2005: 2). One goal of SAS ^{2} is to make participatory research more flexible so that research can be conducted with any group of people in the way most appropriate for them to convey their knowledge comfortably and accurately. In addition, the techniques are more rigorous, combining social research with knowledge assessment and then applying knowledge for future action. All of these can be achieved through the sequential use of a few techniques, or even through the use of a single powerful technique such as Domain Analysis. The ultimate results are that participants are content with their involvement because their knowledge is accurately represented. Since development initiatives arise from their knowledge, participants will also experience genuine and broad benefits.

As a signature technique in SAS ^{2}, Domain Analysis was used for this research to study and compare the mixed cropping systems of Kuvi and Korku *Adivasi* farmers, based on analyses of the farmers' knowledge of their systems. Both *Adivasi* peoples use about twenty-five different crops in their mixed cropping system. Both also claim that maintaining this level of diversity ensures that they will always have good harvests from several of their crops regardless of unpredictable growing conditions, including those that might cause some crops to perform poorly or even fail. Using the Domain Analysis technique along with Rep IV software, however, it appears that there are significant differences between how the two mixed cropping systems contribute to a secure economy for each group.

The Kuvi shifting cultivation seed-mix system is very biologically and ecologically diverse. In Domain Analysis terminology, it is a "fragmented" system, with crops loosely falling into than four distinct families along with several crops being totally unique from all others. The fragmentation of the Kuvi system connotes food security through resilience since a variety of crops are harvestable regardless of how natural events unfold. Seed-mixing a variety of crops for resilience is crucial to Kuvi people for sustainable management of their natural resources (water, soil, forest) and because their remoteness limits their economy to be mostly subsistence based. Unfortunately, the Kuvi seed-mixing also plays a role in limiting the Kuvi economy to subsistence, since its diversity also results in significant competition between crops. While this negatively affects their yielding potential, Kuvi farmers consider it a small price to pay for the assurance of at least getting a reliable harvest.

The Korku system, on the other hand, is identified as a “polarized” system. This is because all Korku crops fall basically into just two families, one with the precise opposing profile to the other. This somewhat supports Korku farmers’ claims since one family of crops will likely thrive under conditions that may cause the other family to perform poorly. In fact, in the event that some crops fail, then space is opened up for other crops to thrive even more through the reduction of intercrop competition. However, there is also a good possibility that conditions will occur that will be adverse for both families of crops. The Korku mixed cropping system reconciles this weakness by improving its diversity in another way: it diversifies the Korku economy by relying more or less equally on both subsistence crops and cash crops. The Korku system thus takes advantage of their relative centrality (compared to the very remote Kuvi people) by employing intensive farming techniques other than seed-mixing to increase yields and incomes along side with mixed stands of crops geared toward subsistence and resilience. The proportion of Korku land devoted to either seed-mixing or single stands depends on the land wealth of a family. A family with less and/or poor quality land will have proportionally more devoted to the more resilient seed-mixing system. No Korku farmer would consider breaking with tradition and risk converting all of their land to cash cropping.

These conclusions about the Korku and Kuvi mixed cropping systems are merely preliminary. Without a doubt, there is additional farmer knowledge that can take this analysis in new and more profound directions, but as a facilitator I was unable to elicit more intimately meaningful core constructs from participants. Overall, this research failed to achieve many of the ideals of “participation” espoused within the SAS^{2} literature (Chevalier and Buckles 2005; 2005b). Many of the shortfalls experienced by me have also been points of criticism toward other participatory systems such as PRA. However, I follow that, contrary to PRA, there are systematic ways in which SAS^{2} techniques such as Domain Analysis can methodologically avoid perpetuating these shortfalls. Most notably, each SAS^{2} method embodies multifarious techniques for eliciting knowledge, and each can also be applied flexibly to be more, or less, complex, depending on the specific needs of the people participating.

In conclusion, it is important that researchers employing participatory methods – SAS^{2} or other – cultivate both an intimate understanding of the people they plan to work with as well as experience and skill with a wide repertoire of useful techniques. Regardless of whatever theoretical and methodological efforts there are to make participatory techniques more effective, they are only actually as good as the practitioners who employ them.

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