Leadership in Common-Pool Resource Management*

Ingela Ternström†

February 17, 2006

Abstract

Why are there leaders? And who are these leaders? In formal organizations and where ownership is the source of power, the answer is readily supplied by economic theory. When organizations are informal and individuals are equals, as in common-pool resource management systems, the theories used to describe resource management rarely incorporates leadership. However, empirical evidence shows that leadership is crucial in these forms of organizations too. The purpose of this paper is therefore to provide a theoretical model that is capable of both showing why there are leaders, and who will be leaders, in groups using e.g. a common-pool resource.

*I am grateful for comments and suggestions from Karl-Göran Mäler and participants at the Beijer Seminar and the SANDEE meeting in Trieste in November 2005. This work was supported by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning.

†The Beijer International Institute of Ecological Economics, Box 50005, SE-10405 Stockholm, Sweden. E-mail: ingela@beijer.kva.se.

1 Introduction

Why are there leaders? All around us, there are leaders. The boss at work and the fotball coach, political leaders and religious leader, leaders of multinational corporations and leaders of rural villages in developing countries, elected leaders and self-appointed leaders, leaders of formal organizations and leaders of informal associations, the list is seemingly endless. Why this abundance of leaders in every aspect of life? What is the economic rationale for having leaders? And how is it decided who will be the leader?

In situations where ownership to crucial resources provides power and authority to certain individuals, the answers to these questions are trivial. However, when we turn to informal cooperation between individuals who are co-owners or co-users of for example a common-pool resource, it is more difficult to find a satisfying answer. Despite empirical evidence of its importance, leadership is given little room in the theoretical literature on common-pool resource management. The purpose of the present paper is to fill this gap.

Although leadership and management is not quite the same thing, the following citation from Milgrom and Roberts' textbook on economics, organization and management provides us with a starting point: "The key role of management in organizations is to ensure coordination. The survival and success of the organization is crucially dependent on achieving effective coordination of the actions of the many individuals and subgroups in the organization, on making sure that they all are focusing their efforts on carrying out a feasible plan of action that will promote the organization's goals, and on assuring that the plan is adjusted appropriately to remain feasible and appropriate as circumstances change."[1] Mintzberg is more specific about why organizations need leaders: To ensure that the organization serves its basic purpose, to design and maintain the stability of its operations, to take charge of the organization's strategy-making and adapt it to a changing environment, to ensure that the organization serves the persons who control it, to be the key informational link between the organization and its environment, and to be responsible for the operation of the organization's status system.[2] Jackson and Carter (2001) also emphasize decision-making: "Organization is the ongoing process of decision-making. Organization requires a process of management and the process of management implies decision-making." Hence, leadership seems to be important both for day-to-day matters and for more long-term decisions.

In management literature there is much emphasis on the crucial role leaders play in the success of business organizations, and when individuals work together in formal organizations the role of leadership is also dealt with in the economic literature, although to a much lesser extent. However, when we turn to less formal organizations, such as groups of individuals using a common-pool resource, economists tend to turn to other theories to explain why it exists and how it works. Non-cooperative game theory has for example been used to show that cooperation between independent individuals is a possible outcome

[1] Milgrom and Roberts, 1992 p. 114
[2] Mintzberg 1973 p. 5.

in repeated games. However, there is a problem in that these games often have multiple equilibria, and very little is said about how the users end up in the "good" equilibrium, or even in the same game.

Coordination was stated by Milgrom and Roberts above to be the key role of management, and coordination games is another way to model informal cooperation. In a coordination game, the actors need to choose the same action or equilibrium. One way to accomplish this is when people in everyday life use symbolic details to create focal points.[3] A problem with this approach is that it is backward looking, which makes it difficult to fit into the concept of rationality.[4] A third approach is to study informal organizations by analyzing their institutions, defined by Ostrom (1990, p. 51) as "the sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions." The drawback of this approach is that it says little about how these rules are developed and changed.

At the same time, there is a growing number of empirical studies showing that in informal organizations, too, there tends to be a leader. There is a large number of case studies that mention in passing or more explicitly that one or a few individuals are crucial to the group's ability to cooperate, see e.g. Ternström (2005 and 2002), Pérez-Cirera and Lovett (2005), Meinzen-Dick et al. (2000), Khwaja (2001). Despite the empirical evidence, this issue is rarely discussed in the common-pool resources literature. The aim of this paper is therefore to provide an economic rationale for these observations and an understanding for how a leader may emerge when there is no formal source of power.

How, then, can the role of leadership be incorporated into theories used to explain cooperation among individuals in informal organizations? In non-cooperative games, one could say that the leader affects the outcome by increasing the perceived likelihood that others will cooperate, that is, by changing the incentive structure. In coordination games, the role of leadership has been described as one of creating or contributing to common knowledge, by making decisions and communicating them to the other users.[5] However, in these theories nothing is said about how leadership is appointed. An area of economics that does look at the choice of leadership is political economy. Here we have the opposite problem - there is no discussion about what the leader can do after he is appointed, and it is implicitly assumed that the winning candidate, once elected, can do almost anything.[6] A key aspect of the organizations we discuss here is that since there is no formal source of power, a leader can only make decisions that are sanctioned by the group.

If we answer the question about why there are leaders right off the top of our heads, many of us will probably answer something like: There has to be someone to take charge, make decisions and take responsibility; to tell us what

[3] See e.g. Schelling 1960.
[4] See e.g. M.C.W. Janssen, 1995.
[5] See e.g. Foss, 2001, and Meyer, 2000.
[6] See e.g. Besley and Coate, 1997.

to do and guide us in difficult situations; someone that has the full picture and the authority to act on it, etc. In short: We need someone who makes decisions for us, but decisions that we like. In a study of farmer-managed irrigation systems in Nepal, the leader was often described as "being at the heart of the system". These kinds of answers serve as my point of departure for developing and motivating another way of incorporating the role and choice of leadership into the analysis of common-pool resource management.

In short, what I suggest is that the role of a leader is to *be* the focal point, or the thing being coordinated upon, rather than to help others develop focal points or coordinate on actions. I do this by simply letting the leader be a person that the others have chosen to listen to. The key results are that it under several different assumptions will be easier to achieve coordination on an individual than on an action, and that there are several ways to identify who this individual will be. I also use the model to analyze the effects of having heterogeneous sub-groups and find that the results are consistent with empirical evidence.

The paper proceeds with presenting of a model for making a more thorough analysis of coordination, both on actions and on persons. In section 3 I combine this model with different assumptions about information and skill, and can then show both why and how individuals may chose a leader. I move on to discussing some effects and possible extensions of the model and end the paper with some comments about the results.

2 The Model

In this section I present a model that will later be used to show that there is a merit to coordinating on a person instead of on an action and how this can be done. The key assumption is that I do not allow anybody to be forced to do anything against their own will. I begin by describing the model for one coordination occasion, and then expand it.

Assume that there is a group of individuals who now and then encounter situations, or coordination occasions, where they can increase their individual well-being by coordinating their actions. It is useful to think about these situations as projects, that can be implemented in different ways, but only if enough of the individuals chose to implement it in the same way, i.e. take the same action. If the project is implemented, those who took this action get a positive utility from the project, while the others get zero utility from it. Thus, exclusion is possible and sometimes voluntary. If too few take the same action, the project can not be implemented, and there is no change in utility for anyone. Examples of such projects are the choice of exactly where to dig a village pond and when to repair the intake of an irrigation system.

Hence, each individual $i \in \{1, 2, .., N\}$, will at each coordination occasion $x \in \{1, 2, ...X\}$ have to chose an action $a \in \{0, 1, 2, ...A\}$, with 0 indicating the option to not act and a_i indicating the action chosen by individual i. Let $\widehat{p}$, the implementation limit, indicate the minimum proportion of individuals that must chose the same action for it to be possible to implement the project, and let $p(a_z) = \frac{1}{N}\sum i\,|a_i = a_z$ be the proportion that chooses a certain action a_z. By assuming that $\widehat{p} > \frac{1}{2}$ we ensure that only one action can be implemented, and by assuming that $N \geq 2$ we make the task less trivial.

The material payoff of a project is $\theta(a_z)\,\pi(a_z)$, where θ is the coordination multiplier and π captures the specific way a project is implemented. The coordination multiplier is decided by the share of individuals that coordinate on the same action in the following way: When the effect of coordination is proportional to the share taking the same action (proportional coordination), we have

$$\theta(a_z) = \begin{cases} p(a_z)\ \ if\ p(a_z) \geq \widehat{p}_x; \\ 0\ if\ p(a_z) < \widehat{p}_x \end{cases} \tag{1}$$

and when sufficient coordination results in full implementation,

$$\theta(a_z) = \begin{cases} 1\ if\ p(a_z) \geq \widehat{p}_x; \\ 0\ if\ p(a_z) < \widehat{p}_x. \end{cases} \tag{2}$$

The utility to individual i of choosing action a_z at coordination occasion x is thus $U_i[\theta(a_z)\,\pi(a_z)] \gtreqless 0$, with positive but decreasing marginal utility and $U_i(0) = 0$. Since nobody can be forced to do anything, neither *ex ante* nor *ex post*, the individuals will not take actions that decrease their well-being, i.e. that has a negative utility to them.[7] Thus, we can define an individual's acceptability set, A_i as the set of actions that will give an individual non-negative utility:

$$A_i = \{a_i\,|U_i[\theta(a_i)\,\pi(a_i)] \geqslant 0\}\,. \tag{3}$$

As we are now interested only in the sign of the utility, and as the coordination multiplier can not be negative, we can disregard $\theta(a_i)$ and this way avoid the circular reference caused by U depending on θ and θ depending on U, and rewrite it as

$$A_i = \{a_i\,|U_i[\pi(a_i)] \geqslant 0\}\,. \tag{4}$$

We can also define an implementability set, I, as the set of actions acceptable to enough individuals that they are implementable, or those intersections of acceptability sets that contains a proportion of acceptability sets at least as large as the implementation limit:

$$I = \left\{\bigcap A_i \left| \frac{1}{N}\sum A_i \subseteq \bigcap A_i \geq \widehat{p}_x \right.\right\}. \tag{5}$$

Now we have enough definitions to start modelling the decision-making of the individuals. As the purpose of the paper is to find a plausible explanation for why leadership is such a common feature even when there is no formal or power-related reasons for leadership, I proceed by comparing two different strategies which I refer to as chose-and-tell and listen-and-chose. The model has three

[7] Note that this is an important assumption that makes this model different from e.g. voting models, where agents are implicitly forced to follow the winning candidate's choices.

stages: The first involves the act of nature that presents the individuals with the coordination occasion, the second is where the individuals follow one of the strategies for choosing action and the third is where the project is implemented, or not. The chose-and-tell strategy implies that an individual privately decides upon an action and announces it to the group. The listen-and-chose strategy implies listening to one of the individuals and choosing whether to do as this individual suggests or not. Note that choosing and telling is in effect equivalent to listening to oneself. Because of the assumption of no forcing, all individuals, irrespective of strategy, will chose actions that belong to their acceptability sets. If in the end enough of the individuals have chosen the same action, the project is implemented.

With this model, if all individuals take the chose-and-tell strategy, we have a situation similar to anarchy and if all individuals take the listen-and-chose strategy but listen to different individuals, no action will be suggested and nothing will happen. If on the other hand at least $\widehat{p}$ of them listen to the same individual, and this individual chooses an action that they can accept, the project can be implemented. However, a crucial question then surfaces: How can we tell who they will coordinate on?

3 Analysis

In this section, I use the model above to analyze the probability of achieving coordination under different assumptions regarding information and skill. First of all, let us state that if $U_i(a_1) - U_i(a_2)$ is small enough $\forall i$ and $\forall a \in I$, then the individuals' utility will be maximized by maximizing θ. If $\theta_x = p_x \mid p_x > \widehat{p_x}$, maximizing θ implies trying to coordinate on actions that are acceptable to as many individuals as possible. If $\theta_x = 1 \mid p_x > \widehat{p_x}$, then it is a matter of getting $\widehat{p}$ of the individuals to agree, and there is more room for a trade-off between π and p. In this section the main focus will be on the coordination multiplier.

Throughout, I assume that preferences are such that each individual is able to perfectly rank different ways of implementing projects, and hence actions, on the basis of his own preferences.[8] I start with assuming that the individuals have no information at all about each other's preferences, and hence neither about acceptability or implementability sets. Next, I look at the situation where all individuals have full information about all the others' preferences, and hence know all acceptability and implementability sets. I then look at an intermediary case, assuming that there is imperfect information. Finally, I introduce a certain type of skill and combine it with the previous assumptions. I use the superscripts $-$, $+$ and $\sim$ to indicate no, full and imperfect information and s to indicate skill.

[8] This implies that preferences are uni-dimensional and single-peaked, which of course is a limitation.

3.1 No information about others' preferences

At each coordination occasion x, the individuals know their own preferences, the total number of individuals, the material payoff function of the project and the minimum coordination required. They can thus deduce their own acceptability set, but nothing more. As there is no knowledge about which actions that are acceptable, we need to make assumptions about this, and to keep things as simple as possible we assume here that all actions are acceptable to all individuals, i.e. that $A_i = A_x \forall i$ and hence that any project gives a positive utility to everybody if implemented. Then, with N individuals and A_x actions, there are A_x^N different ways to combine all individuals' actions and $A_x^{N\widehat{p}}$ ways to combine the actions of $\widehat{p}$ of them, but only A_x combinations that represent coordination.

Given these assumptions the probability P^-_{c-t} that $\widehat{p}$ will chose the same action, i.e. the probability of achieving sufficient coordination with the chose-and-tell strategy is

$$P^-_{c-t} = \frac{A_x}{A_x^{N\widehat{p}}}. \tag{6}$$

A simple numerical example illustrates the difficulties of achieving coordination: With $N = A_x = 2$, there are 4 possible combinations and a fifty percent chance of getting coordination. With 3 individuals and 3 actions, there are 27 combinations and an 11 percent chance of coordination, with $N = 4$ and $A = 4$, the chance is only 1.6 percent. Recognizing that the number of both actions and actors can be quite substantial, and that the number of coordination occasions may also be large, the chances for successful coordination are rapidly dwindling.

The probability of achieving sufficient coordination on an individual, P^-_{l-c}, i.e. the probability that the listen-and-chose strategy results in implementation, is

$$P^-_{l-c} = \frac{N}{N^{N\widehat{p}}}. \tag{7}$$

Which strategy is then to be preferred? This depends on the number of actions relative to the number of individuals, in the following way:

Proposition 1 *When there is only one coordination occasion, the probability of coordinating on an individual is greater than the probability of coordinating on an action iff* $A_x > N\widehat{p}$.

Proof. $P^-_{l-c} > P^-_{c-t}$ implies

$$\frac{N}{N^{N\widehat{p}}} > \frac{A_x}{A_x^{N\widehat{p}}}. \tag{8}$$

Rewrite this as

$$N^{1-N\widehat{p}} > A_x^{1-N\widehat{p}} \tag{9}$$

and again as

$$(1 - N\widehat{p}) \ln N > (1 - N\widehat{p}) \ln A_x \tag{10}$$

Since N is a positive integer, $1 - N\widehat{p}$ is negative (as N$\geq$ 2 and $\widehat{p} > 0.5$), hence this simplifies to

$$\ln N < \ln A_x, \tag{11}$$

and as $\ln y$ is strictly increasing in y, we find that

$$P^{-}_{l-c} > P^{-}_{c-t} \;\; iff \;\; A_x > N. \tag{12}$$

■

So far, we have focused on a single coordination occasion. If we expand our horizon and look at the chances for achieving coordination on all X occasions, we have for the chose-and-tell strategy

$$P^{-}_{c-t,X} = \prod_{x=1}^{X} \left[\frac{A_x}{A_x^{N\widehat{p}}} \right]. \tag{13}$$

If there are as many actions to chose from at all coordination occasions, this can be rewritten as

$$P^{-}_{c-t,X} = \left(\frac{A_x}{A_x^{N\widehat{p}}} \right)^X. \tag{14}$$

Now consider the listen-and-chose strategy. As nobody has any information about anybody else, there is no reason why anyone should listen to different individuals at different coordination occasions. As we assumed above that all actions are acceptable, this can be interpreted as having only one coordination occasion in the listen-and-chose strategy (call this version P_{L-c}). We are then in a position where the chose-and-tell strategy implies trying to coordinate on one of A_x actions at X occasions and the listen-and-chose strategy implies coordinating on one of N individuals at one occasion. We can then state the following:

Proposition 2 *The probability of achieving coordination on one individual is greater than the probability of achieving coordination on one action on X occasions iff $X \ln A > \ln N$.*

Proof.

$$P^{-}_{L-c} > P^{-}_{c-t,X} \tag{15}$$

implies

$$\frac{N}{N^{N\widehat{p}}} > \left[\frac{A}{A_x^{N\widehat{p}}} \right]^X. \tag{16}$$

Rewrite this as

$$N^{1-N\widehat{p}} > A_x^{X(1-N\widehat{p})} \tag{17}$$

and take the natural logarithm to get

$$(1 - N\widehat{p}) \ln N > X(1 - N\widehat{p}) \ln A_x. \tag{18}$$

Since $N \geq 2$ and $\widehat{p} > 0.5$, this simplifies into

$$X \ln A_x > \ln N \tag{19}$$

and we have

$$P^{-}_{L-c} > P- \quad iff \quad X \ln A > \ln N \tag{20}$$

■

Hence, the listen-and-chose strategy becomes relatively more attractive as the number of actions available at each coordination occasion increases and as the number of coordination occasions increase as compared to the number of individuals. That is, the more projects that need the individuals' coordinated efforts, and the more actions there are to chose from, the greater is the benefit from following the listen-and-chose strategy. By rewriting Equation (19) we can find the smallest number of coordination occasions required for it to be useful to coordinate on one individual once instead of one action X times, given the number of individuals and actions available:

$$X > \frac{\ln N}{\ln A}. \tag{21}$$

3.2 Perfect knowledge about others' preferences

With perfect knowledge about not only projects, actions and outcomes, but also about the others' preferences, everybody knows everybody's acceptability sets,and hence the implementability set. Each individual with $A_i \cap I$ will then chose actions that belong to the implementability set while those with $A_i \cap I = \emptyset$ will chose to take no action. With I_x actions in the implementability set, the chances of achieving sufficient coordination at occasion x by using the chose-and-tell strategy then becomes

$$P^{+}_{c-t} = \frac{I_x}{(I_x)^{N\widehat{p}}} \tag{22}$$

and as $I_x \subseteq A_x$ it follows that $P^{+}_{c-t} \geq P^{-}_{c-t}$. The chances for coordination by following the listen-and-chose strategy changes accordingly,

$$P^{+}_{l-c} = \frac{(\sum i\, |A_{i,x} \bigcap I_x\,)}{(\sum i\, |A_{i,x} \bigcap I_x\,)^{N\widehat{p}}}. \tag{23}$$

Hence, which strategy that now provides the best chances for implementing the project depends on whether the number of individuals with acceptable actions in the implementability set is larger than the number of actions in the implementability set.

$$P^{+}_{l-c} > P^{+}_{c-t} \tag{24}$$

if

$$\frac{(\sum i\, |A_{i,x} \bigcap I_x\,)}{(\sum i\, |A_{i,x} \bigcap I_x\,)^{N\widehat{p}}} > \frac{I_x}{(I_x)^{N\widehat{p}}} \tag{25}$$

that is, if

$$I_x > \left(\sum i \,|A_{i,x} \bigcap I_x \right) \qquad (26)$$

which is true if at least on individual has more than one action that belongs to the implementability set.

3.3 Imperfect knowledge about others' preferences

We now turn to the intermediate case where the individuals have imperfect knowledge about each others' preferences in the sense that they know approximately how the others rank different actions. We assume that they know whether a certain individual gives the outcome of a certain action a high or a low ranking but that they don't know the exact ranking and hence not where the line goes between positive and negative utility. In terms of acceptability, this implies that they know for sure that some actions are acceptable, and for sure that some are not, but that there is a range of actions which they are uncertain about. We could say that individuals have a blurred image of the edges of the others' acceptability sets. This means that they also have a blurred image of the edges of the implementability set.

With the chose-and-talk strategy individuals would then chose an action far enough from the blurred borders of I to ensure that the project can be implemented. If we call this "safe" part of the implementation set $\widetilde{I}$, we have

$$P^{\sim}_{c-t} = \frac{\widetilde{I}_x}{\widetilde{I}_x^{\,N\widehat{p}}} \qquad (27)$$

which is even smaller than P^{+}_{c-t}.

The listen-and-chose strategy now becomes a strategic choice of which individual to listen to.[9] Again, the safest action to suggest is one as far away from the blurred borders as possible, and the safest way to get such a suggestion is to let an individual whose preferences are such that his most preferred action, a^*, is in the "center" of the implementability do the suggesting. With the assumptions that the others' rankings are not perfectly known, this translates into choosing to listen to a person whose high-ranked actions are concentrated in $\widetilde{I}$ If there are several such individuals, and if preferences are normally distributed as well as single-peaked,[10] the chances of proposing an action that belongs to

[9] In the first case there was no information at all about the others that could be used strategically. In the second case the perfect knowledge made everybody (with $A_i \cap I$) an equally good candidate.

[10] Grandmont, 1978, (quoted in Green and Laffont, p.212) showed that under certain conditions (if it is possible to parameterise preferences in such a way that the induced distribution of tastes is symmetric in all directions) majority rule fulfills all of Arrow's criteria for a social welfare function. Letting the most "average" individual of those joined by a certain implementability set be the one to suggest action is a similar way of ensuring that the majority will accept the suggestion.

the safe part of the implementability set should be an increasing function of the share of an acceptability set that belongs to the implementability set,

$$P(a^*_{i,x} \in \widetilde{I_x}) = f\left(\frac{A_{i,x} \cap I_x}{A_{i,x}}\right). \tag{28}$$

Then, as $(A_i \cap I) = (A_j \cap I)\ \forall\ A_i\ s.th.\ A_i \cap I \neq \emptyset$, letting the person with the smallest acceptability set among these be the one to propose which action to take will maximize the chances of implementation.

If we do not know if preferences are normally distributed, we should look for an individual whose acceptability set is fully enclosed by the safe implementability set,

$$A_{i,x} \subset \widetilde{I_x}. \tag{29}$$

If there are more than one such person, we should look for the one with the smallest acceptability set among them.

If the individuals have imperfect knowledge in the sense described here, there are ways of identifying the "best" individual to listen to, and thus to ensure sufficient coordination on one individual who will suggest an implementable action. Hence the listen-and-chose strategy will result in

$$P^{\sim}_{l-c} = 1. \tag{30}$$

Furthermore, the individual that is listened to will suggest an action that is in the centre of the implementability set, i.e. that is in some sense fair.

3.4 Skill

Assume now that there is a skill involved in identifying implementable solutions. This skill could be interpreted in two ways; either as an ability to at all, within a given time frame, find an implementable action, or as how fast an individual is at finding it. In the first case there is a risk that a project is lost and in the second case there is a "waiting cost" that is larger the longer it takes to find an implementable solution. Both cases imply a transaction cost of coordinating which is a decreasing function of skill. As above we assume the process of choosing action is in itself not a costly activity.

If individuals differ in their skill at finding implementable actions and their skill is known to all there is an obvious choice of whom to listen to. The transaction cost will be lowest when the most skilled individual, among those with acceptable actions in the implementability set, chooses action. This provides us with yet another way to single out an individual that all will listen to if there is imperfect information about preferences. Furthermore, if the skill lies in minimizing a waiting cost, this is also a way to distinguish between individuals in the case of full information.

Hence, we would have

$$P^{s}_{l-c} = 1 \tag{31}$$

while the effect of skill on the outcome of the chose-and-talk strategy would be rather limited. Here, it would be the skill of the $\widehat{p}$'th person that decides the effect on the probability of achieving coordination. If skill varies between individuals, one skilled individual would not make any difference - with waiting cost, the speed of the $\widehat{p}$'th person decides the cost of the all that join in the implementation of the project. With a risk of losing the opportunity to implement the project, at least $\widehat{p}$ skilled individuals are required in order to get a certain outcome.

4 Discussion

The key results of the section above were that it may under several different assumptions be easier to achieve coordination on an individual than on an action, and that there are several ways to identify who this individual will be. I also showed that coordinating on an action is easier with full than with no information about others' preferences, but even easier with imperfect information. In this section I discuss some further aspects of the model.

Linking coordination occasions

Consider a third strategy which prescribes that individuals chose who to listen to once-and-for-all, or at least for X coordination occasions. Let an individual's acceptability profile, $A_{i,X}$, be defined as

$$A_{i,X} = \{A_{i,x_1}, A_{i,x_2}, ..., A_{i,X}\}, \tag{32}$$

that is, the set of i's acceptability sets for all $x \in X$. Similarly, let

$$I_X = \{I_{x_1}, I_{x_2}, ..., I_X\} \tag{33}$$

represent the set of implementability sets for all $x \in X$. If preferences are stable over time, and the projects of different coordination occasions similar, then we should be able to extend the results regarding deciding who to listen to. Doing this would decrease the number of occasions when there is a risk that coordination is not achieved because of imperfect information, or the total time that is spent on achieving coordination.

How large should X be, or rather when would there be reasons for starting to listen to someone else? If the choice of who to listen to is based on skill, there may be a change in either the distribution of skill within the group of individuals, or a change in which skills are needed. For example, one type of skills may be needed to find a way to coordinate the construction of an irrigation system and other skills needed for coordinating the management of it.

If the individual that is listened to is the one with an acceptability profile that most closely resembles the implementability profile, i.e. the most "representative" individual, changes in the composition of the group will change the implementability profile, and hence who should be listened to.

Material payoff vs. coordination multiplier

We have not fully analyzed the trade-off between the two components of the utility function. The larger is the difference between the individuals' value of different ways to implementing a project, the greater is the trade-off between the material payoff and the coordination multiplier. Above, we assumed that the individuals were not very sensitive to the way in which a certain project was implemented. Of course, if this changes so that it matters much to them that a project is implemented in a specific way (i.e. by taking a specific action), it would become harder to achieve coordination. One effect could be that the number of acceptable actions decreases so much that the implementability set becomes empty.

Group composition

If we assume that the degree of group homogeneity is reflected in the degree of homogeneity of preferences, the overlap of acceptability sets should be large in a homogeneous group, i.e. $A_{i,x} \cap I_x \quad \forall i$. This should make the individuals fairly indifferent to who they listen to, and if the individuals are very similar it may be easier to identify the most skilled than the most "representative" individual.

A heterogeneous group would fit the case described just above, with larger difficulties to find implementable solutions and although for another reason skill may again be the best way to decide who should be listened to.

If the individuals are divided into sub-groups, with similar preferences within sub-groups but distinct differences between sub-groups, the relative size of these sub-groups would decide the outcome. If one of the groups have at least $\widehat{p}$ of the individuals in it, this group can decide the outcome on its own and irrespective of the other individuals' preferences. If neither of the groups are large enough to be independent of the rest, the implementability set may be quite small and close to the borders of the acceptability sets of the individuals in the sub-groups. This may again call for choosing to listen to the most skilled person, whichever group this individual belongs to.

The reasoning above has implications for what happens if there is in- or out-migration as this can change the relative size of sub-groups and hence cause a shift in which subgroup is large enough to control the outcome, or even if there is such a group at all. These indications are very much in line with the results of an empirical examination (Ternström 2005) of irrigation systems in Nepal, where majority strength, measured as the relative size of the largest ethnic group, was strongly correlated with cooperative management of the resource.

5 Concluding Remarks

This paper set out to provide an economic rationale for the empirical observations of the presence of leadership in non-formal organizations. Economic theory often refers to ownership and formal rights when discussing authority, leadership and rights to make decisions. In non-formal organizations, such as groups of equal individuals using a resource in common, these explanations are not appropriate. In the paper, I manage to show that when such individuals need to coordinate their actions, it may be easier to achieve coordination on a single individual than on a single action. This provides an explanation for why there are leaders.

I also provide means for knowing who will be the leader, and show that this will be a person that is, using Arrow's terminology, a dictator, but a "representative" dictator. While Arrow's impossibility theorem[11] states that there can be no social welfare function that is not dictatorial, I show that having a dictatorial leader may actually be a good solution.

The model provides results that are consistent with the empirical evidence. It is for example possible to explain why there is a correlation between decreasing majority strength and the number of conflicts among users of irrigation systems in Nepal, and why sometimes a skilled person and sometimes a representative of the majority group is the leader.

The model fills a gap in the theoretical literature on common property, and provides a way to include a previously largely ignored empirical feature into the analysis.

References

Besley, T. and S. Coate, 1997, "An Economic Model of Representative Democracy", Quarterly Journal of Economics, 112:85-114.

Foss, N.J., 2001, "Leadership, Beliefs and Coordination: An Explorative Discussion", Industrial and Corporate Change Vol. 10, No. 2, pp. 357-388.

Grandmont, J-M., 1978, "Intermediate Preferences and the Majority Rule", Econometrica, 46:317-330.

Green, J.R., and J-J. Laffont, 1980, "Incentives in Public Decision-Making", North-Holland Publishing Company, Amsterdam.

Jackson, N. and P. Carter, 2001, Rethinking Organizational Behavior, Pearson Education Ltd, England.

Janssen, M.C.W., 1998, "Focal Points", in Newman, P.(ed), New Palgrave Dictionary of Economics and the Law, London: MacMillan.

Khwaja, A.I., 2001, "Can Good Projects Succeed in Bad Communities? Collective Action in the Himalayas", John F Kennedy School of Government Harvard University Faculty Research Working Paper Seriec, RWP01-043.

Meinzen-Dick R., Raju, K.V. and A. Gulati, 2000, What Effects Organization and Collective Action for Managing Resources? Evidence from Canal Irrigation Systems in India", Paper presented at 8th Biennal meeting of the International Association for the study of Common Property, Bloomington, Indiana, 2000.

Milgrom, P. and J. Roberts, 1992, Economics, Organization and Management, Prentice-Hall Intenational, New Jersey.

[11] See e.g. Green and Laffont 1980.

Mintzberg, H., 1973, The Nature of Managerial Work, Prentice Hall: Englewood Cliffs, NJ.

Ostrom, E., 1990, Governing the Commons: The Evolution of Institutions for Collective Action, Cambridge University Press.

Pérez-Cirera, V. and J.C. Lovett, 2005, "Poser Distribution,the External Environment and Common Property Forest Governance: A Local User Groups Model", Ecological Economics (In Press).

Schelling, T., 1960) The strategy of Conflict, Harvard University Press: Cambridge, MA.

Sugden, R., 1995, "A Theory of Focal Points" Economic Journal, Vol. 105, pp. 533-550.

Ternström, I., 2005, "Adaptation to Disturbances in Common-Pool Resource Management Systems", Beijer Discussion Paper Series No 197.

Ternström, I., 2002, "Incentives or Coordination? Cooperation in Irrigation Systems in Nepal", The Management of Common-Pool Resources, Theoretical Essays and Empirical Evidence, Ph.D. Thesis in Economics, Stockholm School of Economics.