

APPENDIX 2

Experiment Protocol

Experiment Place

Experiments were carried out in coordination with agriculture field staff at places which are used by field staff for their regular interaction with farmers. Generally the gathering place was a *dera*, it is a facility maintained and owned by large farmers. Importantly this is also the place where community leaders/elders meet to discuss general matters of concern including water disputes.

Choosing experiment participants

In general three methods were used to gather people for a meeting:

- Announcements from Mosque's loudspeaker
- Cell phone messages.
- Word of mouth

In order to choose participants:

- See who is able to understand the experiments clearly by using quizzes

Experiments are to be conducted in groups of 5 with some groups having additional member acting as a leader/elder.

General instruction to the participants

Introduction

This is a research exercise to understand how farmers manage irrigation systems in this area. We are going to conduct an experiment. Each person who takes part in the experiment gets Rs. 60 for just participation. You can earn more during the course of experiment. The money you earn during the experiment comes from a foreign university. The questionnaire and other data collected during the course of this experiment would only be used for research purposes; no part of this data will be available to any government agency. You should listen to the instructions very carefully and ask questions at any point. We will conduct short quizzes to see if you understand the experiment. You can only participate in the experiment when you fully understand it.

Experiment Design

This experiment is based on the real-life scenarios encountered in decision-making with regards to irrigation.

- At the start two people are chosen as elders. The criterion for their selection is age of the participants. The most aged person is best suited to the role.
- **Step 1: All other participants are randomly divided into groups of 5.**
 - In the game these people represent one village sharing a watercourse with discharge capacity of 2 cusec¹.

Also you should know that in the game:

- Each player has 1 acre² of land which they need to irrigate in order to enhance their crop productivity.
- All players are growing the same crops.
- **Step2: Within the group each member is randomly assigned a unique position (1, 2, 3, 4 and 5) by drawing a concealed card.**

The players are called player 1, player 2 etc. (corresponding to their position). During the experiment members of each group as well as the position of these players remain fixed.

Baseline experiment

During the baseline scenario each player has to make two separate decisions. At the time of making these decisions each player acts independently without consulting anyone else. Players are not allowed to talk to each other or say anything in public during the baseline rounds. To ensure that you can make decisions independently, players in the same group are to be seated in such a way that no one is able to see other player's decision.

Investment Decision

- **Step 1: All players (except elders) are provided with an initial endowment (10 tokens).**

Each token represents .80 PKR.

- **Step 2: Decide how much of this endowment you want to invest in the maintenance of irrigation infrastructure.**
 - Everyone writes the amount they want to invest on the piece of paper (decision card) provided to you. You will be asked to hand over this paper to the facilitator after you have made your decision.

1 Cusec = cubic feet per second; 1 Cusec = 28.317 litres per second

2 1 acre = 0.40468564224 hectare

All individuals make their decision simultaneously and independently without consulting other members of the group. You should remember that a fixed amount of water (max. 200 minutes per turn) is discharged from the main canal to your watercourse (discharge-rate of 2 cusec). As in real life this amount is relevant for one turn only.

The amount of water available for participants to irrigate their fields depends upon their collective level of investment. Investment in the maintenance of the watercourse means that less water is wasted. The collective investment for a group is calculated by adding the individual investment of each group member. If in a given round the collective investment is less than 20 tokens then all the water entitled to the group in that round is wasted. Table 1 shows the relationship between group investment and amount of water available (Table 1 is shown by the facilitators).

After investment decision has been made by all group members facilitators publicly announce the amount invested by each player as well as the collective group investment and amount of water available to the group for irrigation.

Table A.6.1. Investment and CPR

Total token investment	Water available for the group (number of minutes)
< 20	0
20	5
21	5
22	10
23	15
24	20
25	30
26	40
27	50
28	65
29	85
30	100
31	115
32	130

33	145
34	155
35	165
36	170
37	180
38	185
39	185
40	190
41	190
42	195
43	195
44	195
45	195
46	200
47	200
48	200
49	200
50	200

Extraction Decision

- *Step 1:* Each player decides how much water to take from the total amount available for irrigating his field.
 - Players decide about the duration of time the tap to their individual field is open. Players are allowed to choose any multiple of 5 between 0 and 50 (minutes).
- The decisions are made sequentially which means that the player who is assigned position 1 (player1) makes the decision first, and then player 2 does the same and so on.

- The water available for player 2 depends upon player 1's decision. Similarly the water available for player 3 depends upon the extraction decision of players 1 and 2. The process is repeated for rest of the players.

Consider this example: If the total amount of water available is 180 minutes, then first player 1 decides how much to take from this. If player 1 decides to extract water for 50 minutes then the amount of water available to player 2 is 130 (180 - 50), so player 2 has to decide how much to take from this amount. If player 2 decides to extract water for 50 minutes then the amount of water available for player 3 is 80 minutes (130 - 50). Player 3 has to decide how much water to take from these 80 minutes. If player 3 decides to take water for 40 minutes then the amount available to player 4 is 40 minutes (80 - 40). So player 4 has to decide how much water to take from this 40 minutes, if player 4 decides to extract water for 40 minutes then no water is available for player 5 (40 - 40).

All individual decisions are made transparent to all other players at the end of the round. Each player knows how much others invested in the first step of the experiment and how much water they took in the second step.

Pay-offs

Earnings consist of two parts:

1. Tokens which were not invested in the investment step of the experiment are kept in the individual's savings account.
2. Tokens earned from utilizing water.

Total earnings = Tokens not invested (savings) + tokens earned from utilizing water.

The amount of water taken (time) determines the amount of tokens earned in each round. Table 3 shows the relationship between amount of water utilized and tokens earned. If for example a player decides to take water for 25 minutes he earns 10 tokens. Table 3 is shown and explained to the experiment participants.

Table A.6.2. Pay-offs

No. of minutes	Tokens earned
0	0
5	0
10	0
15	1

20	4
25	10
30	15
35	18
40	19
45	19
50	20

Question 1: If a group invests a total of 45 tokens, what amount of water would be available to that group?

A: 100 B: 160 C: 185 D: 195 E: 200

Question 2: If two participants invest 10 tokens each and the three other participants invest 5 tokens each, what will be the total amount of water available that group?

A: 0 B: 65 C: 115 D: 165 E: 200

Question 3: If total amount of water available to group is 100 gallons/turn and you extract water for 40 minutes how much water is left for the rest of the group?

A: 0 B: 100 C: 20 D: 60 E: 80

Question 4: If you extract water for 40 minutes how many tokens do you earn from extracting this amount of water (only the token earned from utilizing water not the total earnings)?

A: 0 B: 6 C: 15 D: 19 E: 20

Question 5: If you invest 5 tokens and extract water for 20 minutes, how many total tokens do you earn?

A: 0 B: 4 C: 9 D: 13 E: 18

Treatment Stage

Now we come to the second part of experiment where different treatments are introduced.

Treatment A: Communication

- The first two stages are the same as in the baseline rounds; players first make investment decision and then extraction decision. A third stage is added after all players have made their extraction decisions. In this stage all players are asked to decide simultaneously whether they want to use treatment A (Communication) and if yes against which player(s).
 - Each player is given the sheet “Treatment Decision Card”.
 - Players are asked to write their decision on the card provided by the facilitator. Here you first need to indicate whether you want to use the treatment or not, after that you have to write against which players you want to use the treatment.
- Treatment A allows player to talk with other player(s). Players who opt for this treatment are given fixed amount of time (3-4 minutes per time slot) to talk to other group member(s). The experimenter will make sure that everyone remains within these time limits.
 - In order to use this treatment a player endures a fixed cost (1 token per time slot).
 - In one treatment session the initiator can invite more than one player. Consider for example player 5 if he wants to use this treatment, first he needs to write “yes” in the box “treatment decision” to indicate his intention, then he needs to write against whom (which players) he wants to use this treatment. Say he wants to use this treatment against player 1, 2 and 3. So he writes the position number of these players (1, 2 and 3) on the “treatment decision” sheet. Having more than one player in a treatment session does not raise the cost of treatment session. In a given treatment session initiator can have as many players as he likes.
 - A player can get more than one time slots. If for example player 2 wants to have detailed discussion and thinks that one time slot is not enough, or if he wants to have different treatment sessions for different players, he can get more than one time slot. However he needs to indicate this at the same time as his treatment decision. Also he has to indicate the players against whom he wants to initiate each of these treatment sessions separately even if all the players are same for both sessions. A player should also remember that each treatment slot has its own fixed costs; so one time slot costs 1 token, 2 time slots cost 2 tokens and so on.
- If more than one player wants to talk to the same player then preference is given to tail-end players. This means that initially requests of tail-users are fulfilled before moving onto head-users. Consider for example that both player 5 and player 2 indicate that they want to talk to player 1, in such a case player 5 will talk to player 1 first, and only after the completion of player 5’s time slot player 2 will be able to talk to player 1.

- It must be noted that treatments cannot be used to change the actions already taken before or even during the round in which treatment was initiated. Only possible effects of treatment are for future rounds.

Question 6: Is the communication option free?

A: Yes B: No

Question 7: How much does one communication session (one time slot) cost?

A: 0 B: 1 C: 2 D: 3

Question 8: How many players can you talk to during one time slot?

A: None B: 1 C: 2 D: As many as I like

Treatment B: Traditional leaders

- The first two stages of are the same as in the baseline rounds; players first make investment decision and then extraction decision. A third stage is added after all players have made their extraction decision. In this stage all players are asked to decide simultaneously whether they want to use treatment B (Traditional leaders) and against which player(s).
 - Each player is given the sheet “Treatment Decision Card”.
 - Players are asked to write their decision on the card provided by the facilitator. Here you need to first indicate whether you want to use the treatment or not, after that you have to write against whom (which players) you want to use the treatment.
- Treatment B allows players to take the player(s) of their choosing to a traditional authority represented by an elder.
 - These leaders were selected at the start of the experiment. In all cases, efforts were made to call actual leaders/elders for the role of the elder. However in cases of their unavailability, the most aged person was chosen to act as the elder. During the baseline phase of the experiments, these elders/leaders were kept in a different room. Also, before the treatment phase, the elders did not know which group they were going to be placed in.
 - A traditional leader invites all the players. He first allows the player(s) who has initiated the treatment to present his case (max. 1 min to one person) after that the player against whom treatment is initiated is given a chance to speak. It is the responsibility of an elder to conduct a treatment session so he has full authority over how to proceed in a given session.

- The elder acts as a mediator between these parties to resolve their differences. During the treatment session elder can interrupt at any stage, he can also facilitate in obtaining non-binding commitments from any one of parties involved. Traditional leaders/elders can also enforce informal sanctions such as disapproval of behavior, public embarrassment of offenders, demanding public apology or commitment/promise. It must be noted that all actions as well as demands of leaders are non-binding for participants. Elders do not take part in the provision or the extraction part of the experiment.
 - In order to initiate this option players endure fixed costs (1 token per session).
 - A discussion session is limited to maximum of 3 to 5 minutes depending upon the number of initiators. The experimenter will make sure that everyone remains within these time limits.
 - One player can initiate more than one treatment sessions; however these treatments have to be against different players. In the context of this treatment it means that a player can initiate only one treatment session against another player in a given round. So for example if player 2 initiates a treatment session against player 5, player 2 has to complete whatever he wants to talk about player 5 in this session as he will not get another opportunity to raise these concerns in this particular round.
- If you want to use this treatment for more than one player you need to write the player number in separate boxes in the section marked “players”.
- For example consider you are player 5 and you want to use this treatment for player 1 and player 3, then you should first write “yes” in the box treatment decision. After that you should write player numbers in the next box. In this section there are four separate boxes. For using this treatment against two players (player1 and player 3) first write 1 in the first box and then write 3 in the second box.
 - You should remember that one discussion session is against only one other group member. This means that if you want to initiate this treatment against two players you should get two discussion sessions. However this also means that your costs would be doubled. So without any sharing of costs one time slot costs 1 token, 2 time slots cost 2 tokens and so on.
 - If more than one player decides to use this treatment against the same player in the same round then they share the costs of this discussion session. So consider if player 5, player 4 and player 2 indicate that they want to use this treatment against player 1 then these player share the costs of the same discussion session against player 1. In this (combined) discussion session each initiator (player 5, 4 and 2 in this case) is given the opportunity to raise his concerns. The maximum amount of time available to each initiator is one minute however this is flexible depending

upon the discretion of elder. A discussion session can go on for a maximum of 5 minutes. Cost for each player in this case is $\frac{1}{3}$ tokens (1 token/number of initiators).

- First preference is given to the issues encountered by tail-users. Consider for example that player 5, player 4 and player 2 indicate that they want to use this treatment against player 1, then in the discussion session leader will first ask player 5 to talk then after him player 4 and after him player 2 can raise their concerns. The player against whom the treatment is initiated may be allowed to talk depending upon the discretion of the leader.
- The issues of tail-users are prioritized which means that treatment session initiated by tail-users are conducted first. Consider for example if player 5 initiates this treatment against player 3 while player 2 and player 3 initiate the treatment against player 1 then in this case first discussion will be against player 3, only after completion of this discussion other sessions can begin.
- It must be noted that treatments cannot be used to change the actions already taken before or during the round in which treatment is initiated. Only possible effects of treatment are for future rounds.

Question 6: Is the traditional leadership option free?

A: Yes B: No

Question 7: How much does intervention by traditional leaders cost if you use it against two other group members without any sharing of costs?

A: 0 B: 1 C: 2 D: 3

Question 8: Say you are player 5 and you initiated a discussion session against player 4. Can you discuss your problems about player 2 in this session?

A: Yes B: No

Question 9: If you want to initiate a discussion session against all other group members how many discussion sessions you should get?

A: 1 B: 2 C: 3 D: 4

Question 10: If two players initiate a treatment session for the same player in the same round how much each one of them has to pay individually?

A: 1 B: $\frac{1}{2}$ C: $\frac{1}{3}$

Treatment C: Third-party Punishment

- The first two stages are the same as in the baseline rounds i.e. players first make investment decision and then extraction decision. A third stage is added after all players have made their extraction decision. In this stage all players are asked simultaneously to decide whether they want to use treatment C (Third-party punishment) and against which player(s).
 - Each player is given the sheet “Treatment Decision Card”.
 - Players are asked to write their decision on the card provided by the assistants. Here you need to first indicate whether you want to use the treatment or not, after that you have to write against which players you want to use the treatment.
- Treatment C allows players to punish other player(s). They can report to the “water committee” which is represented by the experiment facilitator. With a probability of $\frac{2}{3}$ the facilitator will punish the person against whom the treatment was initiated. Whether the punished player pays the fine or not is decided by drawing out cards. Punishment amount payable is 4 tokens. It must be remembered that these 4 tokens are subtracted from the earnings of the punished player; however these 4 tokens are not given to the player who initiated the punishment. For the player who initiated the treatment there is no direct monetary benefit attached to the punishment.
 - One player can initiate more than one treatment session; however these treatments need to be against different players. It means that in a given round a player can only invoke punishment once against another player. Consider for example player 4, if desired he can initiate this treatment against multiple players at the end of a round. However he cannot initiate this treatment twice against the same player in the same round.
- If you want to use this treatment against more than one player you need to write the player number in separate boxes in the section marked “players”.
 - For example consider you are player 5 and you want to use this treatment against player 1 and player 3 then you should first write “yes” in the box treatment decision. After that you should write player numbers in the next box. In this section you can see four separate boxes. For using the treatment against two players (player 1 and player 3) first write 1 in the first box and then write 3 in the second box.
- Punishment treatment has a fixed cost (1 token per punishment session) for those who initiate this process.
 - If you want to initiate this treatment against two players then you would have to pay 2 tokens, for three players you have to pay 3 tokens etc.

- If more than one player initiates this treatment against the same player then they share the costs. Consider for example if both player 5 and player 2 want to initiate punishment treatment against player 4 then they will share the costs, which means that each player pays 1/2 token (1 token / total number of initiators).
- The issues of tail-users are addressed first. For example if player 4 wants to use treatment against player 1 while player 2 wants to use treatment against player 3 then first punishment treatment against player 1 is completed before moving onto others.

Question 6: Is the punishment option free?

A: Yes B: No

Question 7: How much does punishment cost if you use it against two other group members without any sharing of costs?

A: 0 B: 1 C: 2 D: 3

Question 8: What are the chances of a player getting not fined once a punishment option has been initiated against him?

A: 1 B: 1/2 C: 1/3 D: No chance

Question 9: Once I am subject to punishment treatment how many tokens do I need to pay as a fine in this round?

A: 0 B: 1 C: 3 D: 4

Question 10: If two players initiate a treatment session for the same player in the same round how much each one of them has to pay individually?

A: 1 B: 1/2 C: 1/3

Treatment D: Mixed

- The first two stages are the same as in the baseline rounds; players first make investment decision and then extraction decision. A third stage is added after all players have made their extraction decision. In this stage all players are asked simultaneously to decide whether they want to use treatment A, B, or C (communication, traditional authority, punishment respectively) and against which player(s).
 - Each player is given the sheet “Treatment Decision Card”.
 - Players are asked to write their decision on the card provided by the assistants. Here you need to first indicate whether you want to use the treatment or not, after that you have to write against which players you want to use the treatment.

- For treatment D each player has the option to choose between different mechanisms; a player can choose either to communicate with other players (A) or involve traditional authorities (B) or use third-party punishments (C). Each option has the same fixed costs (1 token per person).
 - You should indicate which treatment you want to choose in the box “Treatment” on the treatment decision sheet.
- If you want to use treatment against more than one player then:
 - In case you want to use the same treatment against two or more players then write the round number in the first section, “Yes” in the second section, name of the treatment you want to use in the third section and indicate the player’s number (against whom you want to use this treatment) in separate columns.
 - In case you want to use different treatments against different players then add another entry in the row beneath the original one. Both rows should have the same round number. Rest of the process is same.
 - You cannot use more than one treatment against the same player in the same round.

Question 6: How much does a communication session cost if you use it against two other group members?

A: 0 B: 1 C: 2 D: 3

Question 7: How much does a traditional authority session cost if you use it against two other group members?

A: 0 B: 1 C: 2 D: 3

Question 8: How much does a punishment treatment cost if you use it against two other group members?

A: 0 B: 1 C: 2 D: 3

Question 9: Can you choose one treatment for one player and a different treatment for other players in one round?

A: Yes B: No

Question 10: Can you choose different treatments for one player in the same round?

A: Yes B: No