Appendix 1. Game Implementation Protocol.

(Explain experiment goals)

Thank you for being here and giving us a significant portion of your time. The simulations we will do today are part of a larger study across Punjab to understand the different ways in which canal water and groundwater are important to farmers. The results of the study will help us to plan better investments in Pakistan's irrigation system, which in turn can help improve the access that you all enjoy to irrigation water.

(Explain simulations)

Today we are going to do a set of simulations designed to capture some of the experience of using water to irrigate crops within your own farm over a number of seasons. I'll explain how the simulation is done, and then we'll all do a short practice run to learn the simulation. After that, we'll do two full simulations under some different scenarios. In total, this should take about 3 hours, with a few breaks in the middle. You'll each be provided a box of sweet pastries as a thanks for giving us your time, but there is one more thing. We'd like you all to do your best to generate resources in your watercourse in the simulation, so there will be a bonus (an extra box of pastries) for the 1st place finisher in each of the simulations – that is, the farmer who generates as close to the maximum wealth as they can.

In this simulation you'll have a simple farm to take care of. Your farm has an offtake from the distributary/canal that is designed to provide all the water it needs, and if there is enough water in the distributary, you'll receive that amount of water in each turn. If there isn't enough water, you'll receive less than that, or perhaps none at all, if the distributary has dried up before it reaches your offtake. Now, this simulation is simple, and we aren't doing in real time – each turn in the simulation is like a whole season, and the amount of water you get is like the amount of water you get across the whole season. You can think of the amount that you are allocated for the season as being like your warabandi turn, but added up over the whole season. Just like with warabandi, the more water that enters your watercourse (i.e., the longer time each turn you have water coming in), the less is available to enter watercourses downstream. Each simulation has a total of 10 turns, so you could think about it as stepping through 10 separate seasons of irrigating in your watercourse.

The resources you generate in your watercourse in each turn depend on two things – how much water is coming into the watercourse, and how well the watercourse is maintained. If there isn't much water coming in – like when the distributary is dried up – you won't generate much resource. Some turns will have lots of water, some turns will have less. In the same way, if your watercourse isn't maintained well – a s if there is a lot of silting or seepage – you won't generate much resource. In both cases – for maintenance and water in – the resources you get follow an 'S' shape. That is, when you have very low maintenance, improvements don't lead right away to big changes; the same is true when water is really low. In the same way, when you have really high maintenance, or water close to the total demanded by your watercourse, adding more doesn't change your resources much. It is in the middle, in between those extremes, that adding more water or improving maintenance matters the most.

In the simulation, you'll be able to do several different things each turn to try to generate more resources.

The first thing you can do is to lobby for your offtake to be higher. This will cost you some of your resources, but will mean that you will have more water coming into your watercourse in the turns that follow, if sufficient water reaches your offtake. Lobbying in the simulation isn't illegal – it just means that you get more of the water passing your farm, and less moves downstream.

The second thing you can do is invest in maintaining your watercourse. You can think of this as making better use of the water you have. If the maintenance level in your watercourse is low, spending resources to improve maintenance can lead to more resources generated.

The other thing you can do is ask for the offtake of other farmers to be reduced. This costs resources as well, but can help make sure that water makes it all the way to your offtake in turns where there is less water to go around. Even if you are receiving all of the water that you are allocated, you can still protest – perhaps if someone that you know downstream of you is not receiving enough, and you know of someone upstream of them that is getting more than they need. One thing that is really important to note is that protesting is anonymous – none of the other players will know who, if anyone, protested their allocation. So, you don't have to worry about what someone might think if you protested.

In sum, there are three things to think about – how much water do you need, how much water are you allocated, and how much water are you getting. If you aren't allocated as much water as you need, lobbying for more can help you get what you need. If you are allocated enough, but aren't getting enough, protesting the allocation of farmers upstream could help more water to reach you. And finally, if you are getting the water you need, but aren't generating much resources, it may be worth investing in maintaining the watercourse.

Each of these actions has a unit cost – XXX to ask for a YY unit increase in offtake, or XXX to improve maintenance by YYY% – and you can do each of them as much or as little as you like during your turn, as long as you have the resources to pay. We'll look in a moment at exactly how this will happen during the simulation.

(Explain departures from real experience)

First though, we'd like to acknowledge that this is a lot simpler than what it is like to manage a real farm. There are many more decisions to be made in a real farm, and they get made at all different times across a season – not just at once. The simulation we've designed here is meant to help us understand in a very short time how different decisions get made at the farm level, and we hope you will find the experience useful.

(Explain farmer screen)

Now, let's take a look at the simulation. What you see here is the screen you'll see at each one of your turns. The bar across the top of the screen represents the watercourse, before and after water is offtaken for your farm, and lets you visualize how much of the overall water left in the watercourse for the season is used in your farm. The numbers to the left and the right of your offtake are the number of units of water in the watercourse before and after your offtake.

To the right of your offtake you can see how much water it is designed to take, and how much you actually got. If there isn't enough water in the watercourse, you won't get as much as you are allocated. Below your offtake, you can see a picture of a field, representing all the cropland in your farm. The numbers below the field tell you how much water the cropland in your farm demanded, and how far short of this demand the actual amount of water delivered fell.

In the lower right corner, you can see one last set of numbers. This tells you how much resource your farm generated this turn, how much resource you have overall (built up from previous turns), and what the level of maintenance in your farm is.

Your three actions are the buttons at the lower left. If you click on 'Lobby', you'll be able to pay resources to increase the offtake your farm is designed to receive. As you click the '+' button, you'll see how much total water you'll be receiving, and how much it will cost you in this turn to lobby for it. If you want to decrease the amount you are asking for, click the '-' button. When you have the amount you want, click 'Go', and your offtake will be adjusted for your next turn.

If you want to request that the offtake of another farmer be reduced, click on 'Protest'. You'll need to select the farmer from the list, and then, just like with 'Lobby', the '+' and '-' buttons let you choose how much of a change to ask for, and the 'Go' button will confirm it. The total cost to you will be shown at the bottom.

Finally, if you want to improve how water is used in your farm, click 'Maintain'. You'll see a slider showing the current level of maintenance in your farm. You can move the slider directly, or use the '+' and '-' buttons to select the level of maintenance you want to reach, and you'll see the total cost to you at the bottom. Once again, click on 'Go' to make those changes and invest in maintaining your farm.

You don't need to spend all of your wealth in one turn, and it may not be the best thing to do. Sometimes spending wealth on increasing your water offtake or maintenance will pay for itself in an increase in resources, but not if you're already getting all that you need, or if your channel is well maintained. You'll have to decide how best to use your resources.

When you've made all the choices you want, click on 'Next Farmer' and pass the tablet to the farmer downstream of you in the simulation.

While you are waiting for your next turn, feel free to talk with the other players in the game, EXCEPT please do not discuss your game decisions with them.

And finally, remember your goal – to maximize your overall wealth.

We will do a short practice now to get a feel for the simulation. Before we start, are there any questions about the simulation that I can answer?

(Explain again simulation schedule – short practice followed by 2 full simulations)

Ok, we'll start with a quick practice simulation and then take a short break. Following that, we'll begin our two full simulations, taking a short break in between.

(Practice simulation)

In the practice, we've given you a large amount of resources to work with, so you can experience what the different options do. In the actual games, your resources will be much more limited, so take care to see what each action does.

(For each farmer during the practice, highlight what would happen if they did different things. If they change their allocation, their allocation would come closer to their demand. If they change the allocation of farmers upstream, then more of the available water would reach them. If they change the allocation of farmers downstream, they wouldn't see any change, but farmers further downstream would have more water available. If they maintain their properties, they will generate more resources with the water that they obtain.)

(Simulation 1)

(Simulation 2)

Ok, now the conditions in this simulation are a little different. There has been an investment to improve the canal system, and instruments have been installed that let you know how much water is available throughout the system.

In between turns, you can see what else is happening in the other farms along the watercourse. A screen will appear at the end of the cycle and before each farmer's turn that displays information about what happened in all farmers' turns during the last turn. It will display how much water entered the watercourse during the last turn, as well as how much water each farmer was allocated and how much he or she got.

Other than that, the simulation is done just as before.

(At each information screen, highlight the information provided. i.e., Overall there was XXXX units in the distributary. Player XXXX had a total area of WWWWW, was allocated YYYY, and got ZZZZ. , etc.)

Responding to questions

Regarding Lobbying:

In the simulation, you are using your wealth to have the size of your outlet/mogha increased. There aren't any rules in the simulation that say you can't – it's perfectly allowable. The only consequence is that there is less water available for others downstream.