

# NOAA Adaptation Workshop Background Paper

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## 1 Project Overview: Motivation, Hypotheses, and Methodology

### 1.1 Motivation

The motivation for this project grew out of the observation that seasonal climate forecasts have the potential to improve to improve people's lives when and if the information is incorporated into decision-making, but at the same time, many people who could use the forecasts are not doing so. One of the better examples of this came in the wake of the 1997-98 El Niño, and the application of the forecast to decisions by different farmers in Zimbabwe. Field research there indicated that among farmers, the commercial farmers, who received the forecast information primarily from the Commercial Farmers' Union, did put the forecast to good use. The communal (subsistence farmers), who primarily received forecast information from the agricultural extension service, as well as over the radio and in the newspaper, typically did not put the forecast to good use. The purpose of this project was to examine why this might be so.

### 1.2 Hypotheses

Several observations could explain the difference observed. First, commercial farmers received a more complete forecast, including the probabilities for different amounts of rainfall, and a wealth of background analysis. Subsistence farmers did not, and indeed the agricultural extension service made a point of communicating the forecast in deterministic, rather than probabilistic, terms. Second, commercial farmers received the forecast through personal interactions at crop fairs. They had the opportunity to ask questions about the forecast. Subsistence farmers typically heard the forecast over the radio, or from an extension agent. The extension agent, however, often had little training in the forecasts, and was in a position to answer questions. Third, commercial farmers received the forecast at their annual crop fair, a time when they traditionally made many of their decisions. Thus, they would have waited until the crop fair, and hence the time of hearing the forecast, before making crucial decisions. Subsistence farmers, by contrast, heard the forecast relatively randomly, and quite late in the season, likely after when they would have made their typical planting decisions. Fourth, commercial farmers simply had more resources available, and hence could make more decisions in response to new information. Subsistence farmers, perhaps, could not really change anything they did.

The original hypotheses for this project were that all of these reasons were important to some extent. Furthermore, if one could get rid of reasons one, two, and three—communicate the full forecast with analysis in a participatory manner at a time when farmers were planning to make decisions—then even given the resource constraints, farmers would find a way to make different decisions.

Since then, there has developed a further hypothesis. It was no accident that the Commercial Farmers' Union did a better job at forecast communication; it was supported by its members, and charged with helping them with their decisions. The agricultural extension service was more-slow to react, and wouldn't benefit quickly from providing the best possible information, being only indirectly responsible to farmers (via the not very democratic national government). We now hypothesize that farmers react to that very discrepancy, and place more trust in information coming from organizations with direct accountability to them.

### **1.3 Methodology**

Together with Chiedza Gwata at the University of Zimbabwe, I designed an experimental methodology to test these hypotheses, based on social interventions and economic experiments. The advantage of an experimental approach is that it allows one to concentrate on a few variables, by actually controlling for them. The disadvantage of the experimental approach is that its results may not be so transferable to less abstract or more practical situations. One of the primary concerns in developing a social intervention is to structure it so that participating will hurt nobody, relative to how they would have been had they not participated.

#### **1.3.1 Social Intervention**

The main work of the project is in developing annual seasonal climate forecast workshops, and then following them up with a survey to test for the workshops' effects. The workshop, then, is the intervention: supplying a group of people with more information, in a different format, than they would have otherwise received. To test for the effect, we survey people not only who attended the workshops, but also a comparable number of people who did not attend the workshops.

The workshops have taken place annually, every September, since 2000. They occur in four Zimbabwe villages representing the range of subsistence farming rainfall zones. About 50 farmers attend each workshop, and equal mix of men and women. Also attending are the local extension officer, and other local leaders such as school headmasters, headmen, and councilors, and chiefs. The workshops last most of the day, and include presentation of the forecast, some of the science behind the forecast, and a great deal of analysis, including comparisons with local indicators. The first set of surveys occurred in April 2003. I present some key results from those surveys below.

#### **1.3.2 Economic Experiments**

We have conducted two economic experiments, and the graduate student on the project, Pablo Suarez, is conducting two more. A common feature of all of these experiments is that farmers can win significant prizes, based on the decisions that they make in the experiment, and in some cases also based on luck. The first experiment examined farmers' ability to respond to different probabilistic forecasts, and in the more abstract case, a simple gambling game with different probabilities associated with different outcomes. The main lesson of the experiment was that farmers in Zimbabwe did about as

well as the American university students who typically participate in such experiments. Over the course of the hour long set of games, most people—especially women—figured out how best to respond to changing probabilities, and demonstrating that learning by adopting betting strategies most likely to win money for themselves. The results of this experiment have been previously published.

The second experiment has examined the hypothesis that differential accountability of advisors (e.g. forecast communicators) directly influences people's willingness to accept information and act on it. Participants in this experiment played the Monte Hall three door game, and well-known brain-teaser. If people make one choice, they will win the prize with probability one-third. If they make the other choice, they will win the prize with probability two thirds. Past research has demonstrated that, because of several factors, most people opt for the less successful strategy. In our version of the game, a third party (the advisor) provides advice, telling people that they can improve their chances of winning by making the counterintuitive choice. We vary the incentives facing the advisor, and see how the decision-maker responds. The preliminary results, still being written up, are reported below.

The other two games are still in progress. One examines people's potential to integrate information and learn, as a function of the time horizon they are focused on. This experiment also uses the Monte Hall three door game, repeated different numbers of times for different subjects. The final game examines people's time preferences, as a function of their level of poverty, or desperation. This experiment collect background data on people's assets, and compares that with the result of an auction for maize meal. Participants have the option of taking 10 kg of maize meal in two weeks, or a lesser amount immediately. An auction determines each person's amount. Both of these experiments have gone through a test phase, largely successful, but will be changed and repeated. The results I do not present here.

## **2 Results**

Here I present as-yet unpublished results from the two parts of the project. These are based on survey data collected in April 2003, and on experimental data from April and September 2003.

### **2.1 Survey Results**

The most important survey results we expect to start arriving in the second and third year of the survey, as these will allow us time series views into people's lives. However, the first set of surveys still allows us to see some features, most notable the success of the workshop at inducing people to change their planting behavior in response to the seasonal climate forecast.

Figure 1 shows the relationship between forecast use and attendance at a workshop, among those people who had heard about the forecast. The white bars indicate that the person found the forecast useful to decisions she or he was making, and the black bars indicate that the person made a different decision—any decision—as a result of the

forecast information. As one can see, the effectiveness of the forecast at inducing different changes increases first with hearing about the workshop, and most of all by attending the workshop. What we have not yet rigorously analyzed it what different kinds of decisions people in fact did make in response to the forecast.

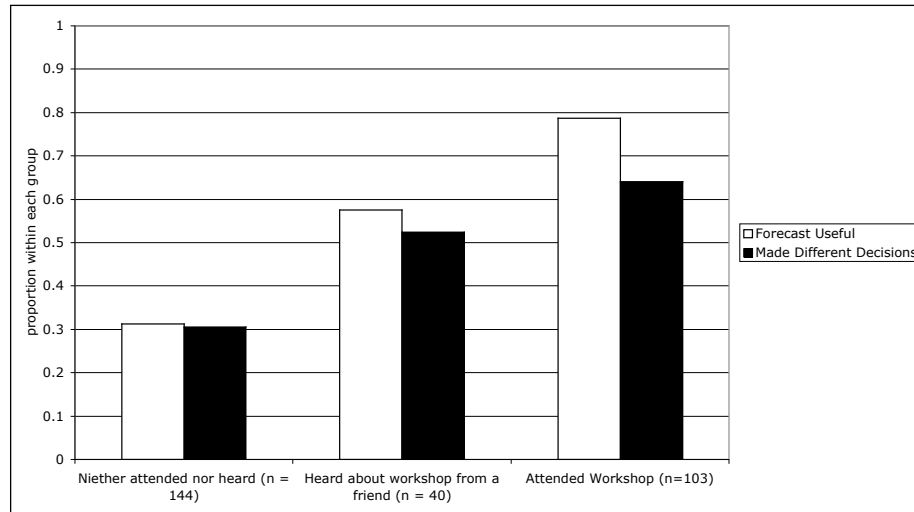


Figure 1—Survey Results of Workshop Effectiveness

We conducted several regression analysis on the data, to see what other factors might have influenced forecast use. At the 99% confidence level, we found that younger people were more likely than older people, attending or hearing about the workshop increased the likelihood, and that living in one of our four villages—Mhakwe—increased the chances that someone used the forecast. Other variables, such as number of farm animals, farm size, education level, and availability of irrigation did not prove significant. Interestingly, Mhakwe is a medium rainfall village. It appeared that people who lived in the highest rainfall village were likely to stick with a long or medium season variety of maize, while those in the low rainfall villages were more likely to stay with a short season maize variety; in Mhakwe, people switched varieties in response to the forecast.

There were some other results that on first inspection appear interesting. For example, there was a gross mismatch between what people viewed as having been their primary challenges in past year, compared to what they viewed their challenges in the coming years would be. Less frequent or non-chronic events, such as drought and flooding, were the most highly ranked problems in the past. Chronic events, such as health troubles and inflation, were the most highly rated anticipated problems for the future. While this may be accurate, it also suggests that people have a cognitive bias, such that they worry the most about the event most visible at the moment. We are planning some experimental work to follow up on this.

## 2.2 Experimental Results

In the experiment, we compared people’s likelihood to follow the counter-intuitive advice coming from advisors with several different incentive structures. One group actually

received no advice, and for this group we observed results in the Monte Hall three door game similar to that in the psychological literature. The next group received advice from an advisor with no clear incentive to provide good advice. This, we feel, matches the institutional framework for much of advising for sustainable development and climate change adaptation; the advice comes from a non-representative government, or from an NGO with no clear stake in people’s lives. The next group received advice from advisors who were paid a fee if their advice was followed, regardless of whether the decision-maker won the prize as a result of following the advice. This, we believe, simulates many pilot projects, including our own, where we are (perhaps unconsciously) trying to demonstrate that a particular approach will be successful at inducing adaptation; the adaptation itself, however, may take longer to prove successful. The next group received advice from an advisor who received his payment if the decision-maker won, regardless of whether the advice was followed. This, we believe, matches organizations such as the commercial farmers’ union, or a representative government. The next group received advice from an advisor whom they had chosen to pay money to in order to receive the advice. This matches the relationship with many consultants. It also created a final subgroup, those who had the opportunity to purchase advice, but decided not to.

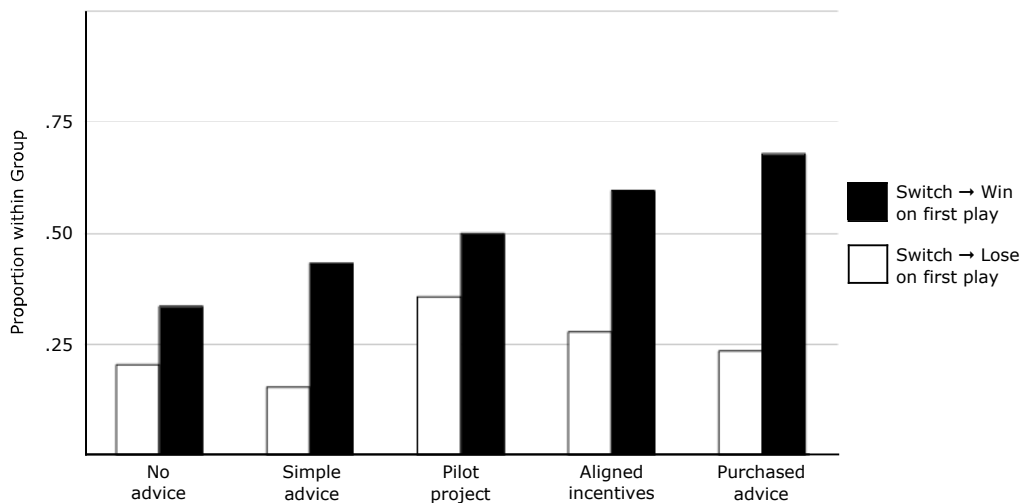


Figure 2—Following advice on the second round of the game

Figure 2 shows the first set of results. The advice that was being offered was to switch doors, which would result in winning two-thirds of the time. By contrast, most people typically stay with their first door, which wins one-third of the time. Figure 2 is shows the proportion within each group that switched on the second round of the game. By this point, of course, they had already observed the first round of the game, in which the decision to switch doors (i.e. following the advice) usually, but not always, won. The white bars show those sub-groups of people within each advice category who had witnessed the decision to switch doors as losing, i.e. the advice had been wrong. The black bars shows those people who had witnessed the decision to switch, and hence the advice, as having been correct. As we can see, providing advice, and the form in which it is given, matters a great deal. We conducted a statistical analysis, and found that relative to simple advice, aligned incentives and purchased advice was more likely to induce a

switch, at the 95% confidence level. Observing the past accuracy of the advice also increased the likelihood, at the 99% confidence level. Finally, not shown in Figure 2, women were more likely than men to switch, at the 95% confidence level.

We have done additional analysis, looking at the discrepancy between the white and black bars of Figure 2 for the different scenarios, depending on the results of the first round of the game. We were especially interested in why purchased advice was especially well-followed after successful advice in the first round, but not at all well followed after unsuccessful advice in the first round. What we have found is that people were much more likely to follow the purchased advice in the first round than any of the other forms of advice, as seen in Figure 3. Again, it can be seen in that all groups receiving advice, women were more trusting than men in the first round of the game.

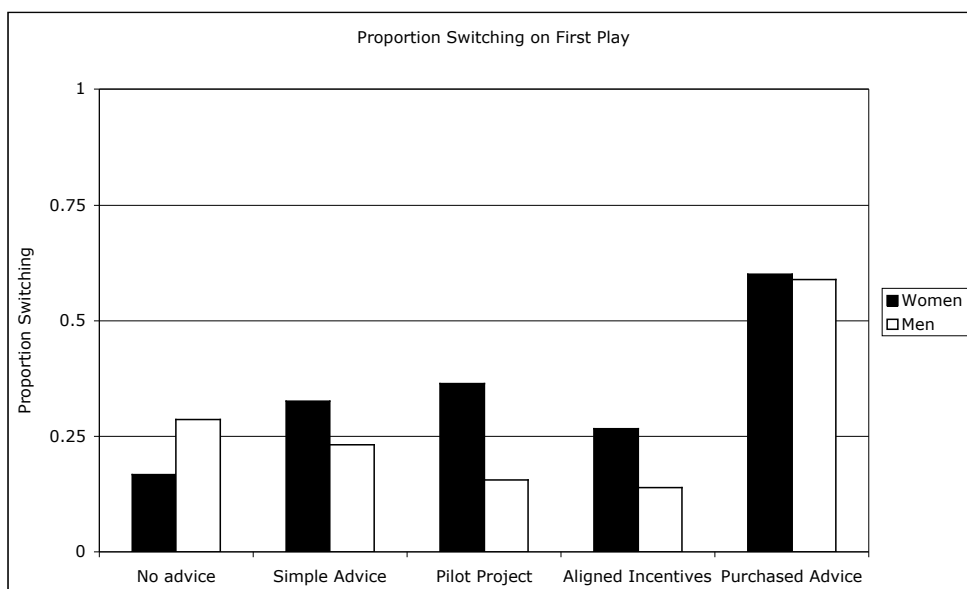


Figure 3—Switching on First Round of Three Door Game

However, the fact that they were trusting on the first round did not always translate into trust on the second round. People who had trusted in the first round, and then lost, were the least likely to trust in the second round. By contrast, those who trusted in the first round and won were the most likely to trust in the second round. This difference was especially marked among women. The fact that more people had trusted in the first round for purchased advice meant that the differences in the second round were the greatest.

### 3 Relevance for Longer Term Adaptation

These results are as relevant for adaptation to longer-term climate change as they are to inter-annual climate variability. To summarize, five points emerge as especially relevant:

### **3.1 Good communication practices are essential**

The workshops that we conduct represent our best effort at good communication practices. These embody personal interaction, a presentation of scientific uncertainty, comparisons with local knowledge, and repetition at a time appropriate for decision-makers to incorporate the information into their choices. The survey results indicate that attending a workshop of this kind more than doubled the chances that someone would take an action, any action, in response to the information.

### **3.2 Available choices matter, perhaps more than resources**

The survey results indicate that Mhakwe, the middle rainfall village, was the most successful at incorporating the forecast into decisions. In part this may be because in the workshops we focused on different maize varieties, rather than other planting decisions, and it is in Mhakwe that the choice of maize varieties is both important and subject to change. But this result does show that there is not a linear relationship between wealth and likelihood of adaptation; in our wettest, and wealthiest, village, people were less likely to use the forecast.

### **3.3 Incentives for institutions have a direct effect**

The literature on knowledge transfer for sustainable development has long showed that institutions with direct accountability to users are more trusted. However, this has, in part, been attributed to the better information content that such institutions generate. In our experiment, we show that there is a direct effect of accountability and incentives, even when the information content remains the same.

### **3.4 Conservatism can pay off**

Our final result from the three door game shows the risks of generating too much trust too soon. It is vital to think in the long term, and to give people an opportunity to evaluate the content and the quality of the information, rather than pressuring them to act on the information before they are ready. If the information is perceived as wrong, people who used it early on may be less likely to evaluate it fairly in later years than those who stood more on the sidelines at the beginning.

### **3.5 Gender matters**

In all of our experiments, women have consistently outperformed men. In the first experiment on probability interpretation, women learned significantly faster than men to respond wisely to changing probabilities. In the three-door game reported here, women showed both higher level of trust, and faster rates of learning even absent advice.