Using Western Water Management Tools and Techniques in China

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This paper tells the story of the Yellow River Basin Water Resources Economic Modeling Study (YRBWREMS). It focuses on the ways in which Water Resources Management, Inc. (WRMI) overcame cultural and communications barriers in developing new tools for the Yellow River Conservancy Commission (YRCC).

Economics, Multiple Objectives and Chinese Culture

Water Resources Management Inc.'s involvement in the YRBWREMS started in 1989, with a visit to the PRC, and continued to 1994. While we were invited to bid on the project, the visit was largely speculative. The request for proposals was clearly directed at developing an economic input/output model of the Yellow River Basin, and economic models are not WRMI's speciality. WRMI specializes in the development of operations models for multi-objective water management.

During the visit, we stressed that market driven allocations of water are very unusual anywhere in the world, including the U.S. We felt they would be particularly unlikely in the PRC, and even less likely in the Yellow River Basin, where allocations of water to the semi- autonomous regions in the basin are as much (or more) a matter of political stability than of economic development. We argued that the most beneficial use of analytical tools would be to demonstrate the direct economic costs and benefits of alternative, implementable, command and control allocation policies. This information could then be used as a factor in designing such policies. Clearly, it would not be the only factor. We also suggested that displays of other direct objectives (e.g. grain production by region, municipal and industrial water deliveries and shortages) would be of very useful in deciding among allocation policies. As the result of our trip and their proposal Water Resources Management, Inc. was indeed selected as the consultant for the Yellow River Water Resources Economic Modeling Study.

WRMI's background in resolving multi-objective multi-party disputes has demonstrated time and again that understanding the culture and values of the client are extremely important in helping them solves complex water management problems. As a result, substantial time was spent on reading cultural background material prior to the trip to China. Cultural material that was studied included more on business practices and what would be expected at cultural events than on actual practice of water management in China. This turned out to be very important. One of the major factors the Chinese were looking for, in deciding upon a consultant, was a feeling that they could work with the foreigners. The simple knowledge of when to make a toast and what to say at a banquet were extremely important in showing that cooperation was possible.

It was clear from the beginning that translation and working across languages, cultures, and time zones would be a challenge. As was recommended in the materials that we studied in preparation for the trip, it was very important to be relaxed and responsive to the Chinese questions. Sometimes those questions seemed to have little to do with the topic being discussed. Most often this was due not to a lack of understanding but to difficulties in communications, as the Chinese are fond of saying. It seems to be very difficult to translate Chinese word for word into a western language. Differences in natural word order, grammar, tenses and an underlying cultural point of view tend to make word for word translations unintelligible. We were prepared for this. In working with the translators, we would try to present things in a way that required frequent responses. When the responses seemed not to make sense, we would point out that we did not understand the response and then try to rephrase our previous ideas. It could take four or five passes before the proper ideas were communicated between the sides.

In some cases, differences in cultural expectations were the root of the problem. This was most likely when what we were discussing depended on interpersonal interactions, such as Chinese seeking help or information from other Chinese, or with inter- or intra-agency procedures. It also happened when discussions assumed knowledge of a wide variety of disciplines, as training in China is different and often more narrowly focussed than training in the U.S. In such cases it was necessary to stop the conversation and

backtrack until the cause of the disconnect was identified. As a result, communications were very time consuming and required a great deal of patience. Success was very rewarding on a personal level. Nonetheless, as a practical matter, face to face meetings took three to four times longer to accomplish the same objectives as they would in the U.S.

Objectives of the Study

As is true with almost any effort to analyze a water problem, there were multiple objectives among the participants in the YRBWREMS. The major participants were the YRCC and, the World Bank. All had different objectives, and the following discussion should shed some light on how the study was performed. The primary YRCC objective was to build a working computer model of the Yellow River. That model was to allow them to evaluate the implications in various management strategies for the river. The Chinese had a secondary objective of technology transfer. They wanted to learn to use modeling technology on other river basins in China. The World Bank had quite a different objective. The World Bank wanted a tool that would allow them to do traditional economic analysis of proposed projects on the Yellow River. Evaluation of strictly economic impacts using input/output analysis, as opposed to the broader-based social, economic and environmental impacts that were of interest to the Chinese, caused a friction between the two parties from the beginning. Fortunately for Water Resources Management, we were selected and hired by the Chinese. While it pleased our Chinese clients to provide the World Bank with tools, it was clear to us that our first priority needed to be to the Chinese objectives.

WRMI believed that the most lasting value from the project would be in the training that could be delivered to the Chinese working on the project. As a result, the entire work plan and schedule was designed to have maximum involvement of Chinese staff at every step of the way, with the American consultants serving primarily as supervisors and advisors. Delivery of the product, a working model, was clearly a bottom line for the project. However, WRMI and our Chinese clients agreed early on that the product would be primarily a Chinese product. Clearly without the full cooperation and active and continuous participation of the Chinese staff, no product could have been developed. Taking this approach was clearly a risk for WRMI. We were contractually obligated to provide the model. To some degree, our desire to do an interesting and worthwhile project overrode our contractual good sense.

Contract Negotiations

The contract negotiations were unlike any contract negotiations that the author has been involved in the United States or elsewhere. Both sides knew going in what the budget was and both sides fully expected that it would be completely exhausted. A reasonable formula for setting the billing rates for all parties was easily agreed upon. As a result, the contract negotiations were mainly about how to structure the work to get the most benefit for the Chinese from the dollars that were to be spent. Since WRMI s objective was to provide training, and because this fit nicely with the Chinese objective of technical transfer, it was clear that most of the work would be done in China. But, this stipulation never made it into the formal contract; it was handled almost entirely by a gentleman s agreement.

The Chinese had little experience with computer hardware and software. We at WRMI believed that the best way to provide technology transfer was to bring in a large number of relatively inexpensively, state of the art, personal computers. However, there were many Chinese experts (called collectively the "mother's in law" by our clients) who doubted the ability of such computers to perform the required calculations. The Chinese insisted that approximately 40 percent of what turned out to be the computer budget was to be spent on a UNIX-based workstation. In the end, the workstation provided almost no support for the project. It did, however, increase the perception of the project stature among other Chinese and it increased the stature of the department doing the project in the eyes of the remaining departments in the Yellow River Conservancy Commission. While the author believes that the workstation was of little value from a technical standpoint, it may in fact have had a salutary impact on the overall success of the project.

The contract negotiations turned into an activity designed to produce an acceptable and effective work plan for the overall project, no more, no less. The author, sole representative of WRMI, and about twenty-five Chinese worked for two days to prepare the budget and labor estimates. These were produced - on the fly - using the author s portable computer. At the conclusion of the negotiations, the chief representative

of the Ministry of Water Resources, who was fluent in English, rose and exclaimed Ho, I am exhausted. The author replied, You're exhausted? There were twenty-five of you and only one of me. Yes, he said, but you had the computer.

Staffing

At the end of the negotiations, the Chinese had committed to provide a staff of eighty professionals. The American staff would be about twelve. The work would be done almost exclusively in China and the Americans would use students from the University of Texas, LBJ School of Public Affairs, carry-on some of the training and some of the work in use of personal computers. The Chinese were to be almost exclusively responsible for providing the data. The American staff was ultimately responsible for all the coding and provision of the models but was committed to having as much of the programming done by the Chinese as possible. American specialists were to be brought in to give short courses to the Chinese on the theory underlying the techniques they were implementing in code. Production runs of the model were to be done and evaluated by the Chinese. The arrangement for the evaluations to be done by the Chinese served two objectives. The first, of course, was training. The second, was simply to keep the Chinese evaluation of their own alternatives private among the Chinese. This turned out to be the first manifestation of the largest single problem in performing the project, at least from WRMI s point of view. That problem was the reluctance of Chinese, in general, to share data among themselves or with foreigners.

The Chinese staff was exceptionally well trained. We found them to be bright, energetic, and very hard working. Our observation was that the thing that most distinguished them from the American trained counterparts was the narrowness of their training in specific disciplines. The American students who came to China to assist with the project had a much more shallow knowledge of the technical information and concepts that underlay the analysis than did their Chinese counterparts. But because the Americans understood more of the aspects of the entire problem, they were much better able to visualize the entire work effort.

One of the most fortuitous decisions of the entire project was the Chinese decision to assign bilingual Chinese to work with the Americans. These Chinese were quite fluent in English, and particularly in technical terms. Their ability to deal with the technical aspects of translation exceeded that of the best translation staff assigned to the project, and was absolutely vital. For most of the effort in China, the Americans could work directly with their Chinese counterparts without the aid of a translator. It is impossible to understate the importance of that assignment of bilingual Chinese to the success of the project.

Another unique aspect of the staffing of the project was the use of the University of Texas LBJ Public Affairs School students for carrying out a good deal of the training in software and some of the grunt work to be done by the Americans in China. This was important on three counts. First, students were an inexpensive source of labor for the project. Second, the students from the University of Texas learned an enormous amount about working on international projects and the skills of their Chinese counterparts. Third, and very important, because of the lower stature of the students, as opposed to that of the (mostly Ph.D.) professionals on the American side, the students were not treated as formally as the professionals. This meant they had much easier assess to the lower levels of the Chinese staff, the very people we were trying to train. WRMI made no profit on the student's work, but from the standpoint of the success of the overall project and the satisfaction of the client, the students were a tremendous asset.

Beginning the Project

It was apparent at the beginning of the project that overcoming the formality of communications between the Chinese and Americans was going to be crucial to completing the work in a cooperative manner. Our objective at WRMI was to bring our Chinese counterparts up to speed immediately in the areas of programming sophisticated water resources simulation models on IBM 486 PC level machines. While most of the Chinese staff knew Fortran, none had any real experience with modern programming tools, editors, debuggers and programming environments. Simplifying and stereotyping the American style of learning such tools is simply to start, dive right in and ask your colleagues lots of questions. This is not the Chinese style. The Chinese style, again, stereotyping and simplifying, is to delve deeply into the manuals and figure everything out for yourself. Asking for help involves something of a loss of face. This, coupled with the formality of the communications between the

Americans and the Chinese, made it extraordinarily difficult to bring them up to speed.

A way had to be found to "break the ice." Americans began teaching the Chinese, not formally, but by having them watch. That is, the Americans would sit at the computers and the Chinese would stand behind watching what happened on the screen. When one of the Chinese students would see a typographical error that was causing extreme pain in compiling the program, he would point it out. This was complimented profusely, giving face to the student. The reaction of complimenting the student was un-Chinese; in China any correction of the professor's work is seen as a great loss of face for the professor. We did our best by our reactions to make it clear that we did not consider this to be a loss of face for ourselves. Our Chinese students were very bright and soon their comments progressed from typos to logical errors. Programming in a fish bowl, as we were doing, is difficult, but it was certainly helping our students learn.

After several multi-hour sessions of this kind of teaching and learning, the Americans turned to the Chinese students and said, sit down. Now you do it. The Chinese reaction was absolute terror, judging by facial reaction. But the poor student, now also a friend, was in a position where he could not refuse. The student, of course, made mistakes. But, our reactions to those mistakes were always positive, always giving face to the students. It soon became clear that we thought it was perfectly acceptable to ask questions and take advice. From then on, the training proceeded very quickly, mostly American style. Within a month the Chinese had programmed, largely on their own, prototype simulation models which used network algorithms as "drivers." We had overcome a great "difficulty" in communications. The Chinese managers of the project were most impressed with the progress of their own employees.

Bridging the communications gap with the Chinese managers of the project was equally difficult. It also required the establishment of social interaction. Clumsy attempts at learning the language provided a perfect opportunity. As project manager on the American side, the author decided to use the language as much as possible (in fact more than was possible). With the difficulties of tone and lack of common words, certainly many of the things said seemed quite silly in Chinese. But while silliness provoked laugher, there was a great appreciation of the effort to learn the language. Mistakes provided the Chinese with an opportunity to help (and supervise) the foreigners. This "leveled the playing field," at least in some sense, and greatly increased our feelings of cooperation. The cooperative spirit was very important to our Chinese counterparts.

The Problem of Data

In all regards, obtaining the requisite data was the most difficult part of the project. First, the realities of survival in the Communist system promotes the keeping of the two (and sometimes more) sets of books for technical as well as financial data. One set of books is designed to demonstrate how efficient production had been. The second was designed to support the requests for additional resources. Not surprisingly the data in each set of books was different. It was impossible to determine which, if either, better represented physical reality.

Second, in China that data is power. Most people, professionals included, are quite reluctant to part with data which they control. Sometimes they are willing to sell the data. But, buying data requires paying two prices. There is, of course, the monetary cost, which is usually modest. But in addition, there is "guanxi." The act of giving up the data, even if it is purchased, is seen as granting a favor. And in China, favors (guanxi) must be repaid. While our project could have paid the financial price for the data, data is widely distributed in China. The number and size of the social repayments necessary made it impossible for our clients to obtain much of the data we could have used. The problem with data extended from social and economic data to simple hydrologic data, and was compounded by a general reticence to make any data available to foreigners. In the end we wound up synthesizing records which did, in fact, exist and which would have been readily available in the United States.

Choosing the Underlying Methods

The problem of choosing the science base for the models was much less difficult than the problem of obtaining data. The hydrologic models were based on simple mass balance using monthly time steps. A network algorithm was used to match flows and demands. A number of techniques were available to model agricultural production, and our clients (who were not agriculturalists) displayed no strong

preference. We were concerned, and properly so, that the agricultural models reflect Chinese data since the agricultural models were empirically based. We did our best to fit the limited Chinese agricultural data made available to us.

Economic evaluations in the models were based on world commodity prices for the grains and other products. No attempt was made to use input/output type methodology to estimate economic effects. The author believes this was appropriate given that water is allocated in command and control fashion in China (and virtually every where else in the world, for that matter). Moreover, most of the economic inputs required for agricultural production in China are also distributed on more or less command and control basis. Our assumptions coincided nicely with our Chinese counterpart's interpretation of the way agriculture and water allocation worked in China. Therefore, we used water as the sole determinant of changes in yield in evaluating alternative policies. Hydropower was evaluated as the cost of replacement power from coal fired generation.

Importantly, no economic value was assigned to urban and industrial water uses. Instead, projected urban and industrial demands were given absolute priority over agricultural deliveries. These assumptions clearly reflect our Chinese counterpart's view of the way water is allocated. They believe that water in urban use in China will always have a higher value than it will in agriculture. And, within the range of alternatives likely to be evaluated using the models developed for the YRCC, this is probably correct. Unfortunately, these assumptions are very much at odds with those preferred by World Bank, the provider of the credit, which funded the project. When it became apparent that input/output analysis would not be used, the World Bank began a parallel development of a set of input/output models for determining economic values of water. These will be discussed later.

Sediment is a serious problem in the Yellow River (a gross understatement for a river that can flow 60% by weight solids in flood). However, we were not allowed to model the movement of sediment in the river. This was because the Chinese believed (with good reason) that they were the world's experts on sediment flow in the Yellow River. Our numerous suggestions that functions describing sediment transport be explicitly included in the model were politely yet firmly refused.

Methods Reports

At the end of the project s first year, a series of reports on the methods to be used and incorporated in the final production models were issued. These reports had two different objectives. The first was to document the progress to date. They described the prototype models which had been running and refined since about the first month of the project. They also documented the training that had been done. Most important from the American side was that they documented the responsibilities of the
Chinese to provide the data that would be necessary to complete the project based upon and agreed upon set of methods. These reports were the first large salvo in a continuing battle to get the data required to finish the project.

By that time the American had allies in the battle, the students who had been trained on computers. They began to understand and grasp the overall complexity of the project and the entire scope of what needed to be done. They had learned this from the American professional staff and just as importantly from the American students who were working shoulder to shoulder with them. It was becoming clear to the Chinese in the computer lab that without the appropriate data the project simply would fall apart. On their own initiative, they began the difficult task of convincing their Chinese counterparts that it was essential that data be made available. On the American side, we were becoming confident enough in the abilities of the Chinese we had trained to delegate the task of evaluation, so that the foreigners did not have to see all the data or all of the results. This had the effect of removing at least one of the barriers to transferring the data: the reluctance to give such data to foreigners.

By the end of the first year, a personal computer lab worthy of any university had been installed in the project offices. American students and Chinese professionals were working shoulder to shoulder. American professionals were directing the students and English proficient Chinese and doing their best to manage the project cooperatively with their Chinese counterparts. Interestingly there was no network in the computer lab despite efforts on the part of the Americans to have one brought in and installed. Some of the Americans saw this as a simple extension of the

Chinese proclivity not to share data.

When Are We Done?

In the long run, waiting for the data ate up a large portion of the project budget. The American side scheduled trips to China on the assumption that data would be available. When it was not, much time effort and travel monies were spent with less than optimum results. Eventually, the decision had to be taken to use whatever was currently available for calibrating the models and to use that in the final reports. Moreover, by that time, the Chinese were comfortable enough with the models, confident enough in their abilities and reticent enough about sharing data to want to do the final evaluations of alternatives outside of the view of foreigners (and anyone else for that matter). For the Americans this was both encouraging and disappointing. Disappointing because we never got to use the models we had worked so hard to develop. Encouraging because we knew that our Chinese friends were by then fully capable of carrying out the work themselves.

At about the same time as the projects final reports were being written and issued the results of the World Bank's input/output modeling efforts were becoming available. The YRCC models, included more than two hundred separate inflow and withdrawal points. The Bank's models included only nine points, one for each province along the river. Both models operated the major reservoirs. The Bank's models were input/output models assuming economic values and pricing for production for all of the commodities. The YRCC model allocated water under command and control strategies and was capable of testing the impact of different command and control strategies on economic output project models were based initially on historical command and control allocations and could match historical flows in the rivers within fifteen-twenty percent at all points. The Bank's models matched gross basin outflow equally well but allocations to the individual provinces could be off by as much as 75 percent or more. Two sets of models clearly demonstrate the difference in philosophy between models grounded primarily on physical reality and models based primarily on economic theory. Clearly the Bank preferred the latter. The YRCC (and WRMI) prefer the former. The author believes that a lively debate over the merits of using either approach for actually making management decisions about the resources would be beneficial to all.

Conclusion

This short paper has focussed on the ways in which WRMI overcame cultural and communications barriers in developing new tools for the YRCC. In particular, we were fortunate in being assigned fluent English speakers as primary trainees. Their grasp of technical language was most important, and minimized the impacts of the language barrier. In turn, they provided the most effective possible training to other Chinese. Even with the reduced language barrier, training styles needed to accommodate the Chinese. Fortunately we were able to enable our students to adopt a more Western, and we believe more rapid (though probably less thorough) training technique. Availability of good data is crucial to any analytical work. While we were able to make our clients understand this necessity, we and they were unable to fully overcome social and cultural obstacles to obtaining full data sets within the time allotted. The ability of the Chinese to carry on the work, and to evolve the models they helped develop can partially mitigate this problem.

In the final analysis, the project was most successful in meeting the objectives of both WRMI and of the Chinese. The Chinese obtained a full working model of the river which they continue to use. Because the Chinese were heavily involved in model development and programming, the model can continue to evolve. A number of reports were produced to document the model

and the data that were used to develop it. The goal of transfer was obviously achieved. A great deal of training of American students also took place; the experiences of working under difficult conditions on real projects was most useful to the LBJ school students. A great deal of goodwill was generated, and all participants gained an increased appreciation of the social and cultural values. As a result of the project, a number of Chinese have come to the United States to study as students.

Water management, and resource management generally, must be suited to the physical reality and to the social and cultural values of the specific geographic area. Traditional (monetary) economic values are but one of the factors which must be considered, and often not the primary factor. Multi-objective analysis is much more appropriate than standard (again monetary) economic analysis in dealing with such problems. The water managers at the YRCC understood this, and chose the form of their analytical tools accordingly.

In working across cultures to develop management tools, it is vital to understand the local values and to incorporate them in the analysis. Understanding local values is not always easy, and understanding them is very different from adopting them. In working across cultures, there is a premium on developing ways to communicate ideas clearly. It is always appropriate for those working in water management to use such communications channels to inform their clients that other value sets exist, and to explain them. It is generally not appropriate to impose those values on the client's decisions.

The consultant needs to understand the things his client wants to achieve and to advise the client as to other possible objectives. The tools used should demonstrate to the client alternative ways of achieving economically and socially (including environmentally) efficient mixes of those objectives. It is the client's job to choose among efficient alternatives. "Tell them what they can do, don't tell them what they should do." is the simple principle that helped steer the YRBWREMS to success.