Data Base and Research Methodology for An Assessment of the Lower Moulouya Irrigation Project

prepared under

AID contract

AID/NE - C - 1507

Data Base and Research Methodology

The lower Moulouya irrigation project brought a major infusion of capitol, technology, and labor into a small region of Northeast Morocco. In parts of the region a new productive technology was introduced, farm size changed dramatically, and a new animal husbandry emerged. There has been an enormous change if one simply compares the region in 1978 with what it had been in 1954. The methodology of this study, however, was designed to compare the developmental change in the region from 1960 into the next century with what it might have been had there been no irrigation.

Project.

Estimates of Historical Trends

It was necessary to identify certain patterns and trends in the preirrigation period that would likely have shaped the region had there been no project. Fifty years of high population growth with no signs of slowing down, a shift in agricultural land use from grazing to cereal production, a massive export of labor, and a great annual variation in rainfall were, as pointed out in the body of the report, the most important factors that suggest developments that would have occurred in the absence of the project or other major intervention. No particularly sophisticated methodology is required to identify these patterns if one has reliable data; the problem was primarily one of locating data sources. Reports of observers, colonial records, and a few excellant scholarly studies provided us with the information from which we drew our conclusions. We found nothing as detailed or

comprehensive as we had wished, but this is not surprising. Reliable regional data were not routinely recorded by colonial administrators and if recorded not preserved.

In spite of the poverty of quantitative data, we are confident of our conclusion for two reasons. First, all of the available data on a certain variable lead to the same conclusion. For example, all the data we have on population points to a high rate of growth; nothing suggests the contrary. All the data suggest a shift over time from grazing to cultivation, nothing suggests the opposite except where pump irrigation was developed. Second, the data on all four variables are highly compatible. We would have been highly suspicious if for example, we had found evidence of a growing population, a shift of land from cultivation to grazing with no increase in urban population, and a decrease in labor emigration. But a growing population, low average rainfull with high annual variation, combined with attempts to increase the intensity of land use and labor migration are mutually reinforcing. It is a very plausible combination of variables.

The direction of change leading up to the project was very clear even though estimates of the precise magnitudes of specific variables at specified point in time was only rarely obtainable. Except for the small region under French management that was irrigated with ground water, the local economy was deteriorating. But in order to make some reasonable speculations about the probable course of events in the absence of irrigation we had also to identify other factors which had

their impact along with the introduction of irrigation. Two such factors of significance were identified: the coming of independence and the labor migration to Europe.

It is impossible to get any precise measurement of the economic effect of the coming of independence at the Northeast. The data are simply not available. But the problem is not one which demands refined data and sophisticated analysis. It is the general nature of the impact that is important and that is quite clear from government reports and secondary sources. Before independence the economy of the Northeast was more tied to that of Western Algeria and secondarily to Spain through Melilla than to the centers of Moroccan economic activity on the Atlantic plain. With independence these economics ties were greatly weakened and the local economy was badly hurt. The government reports looking into the problems in the Northeast confirmed that the initial impact of independence on the Northeast was to exacerbate an already declining economy.

The large scale labor emigration to Western Europe beginning in the 1960's greatly stimulated the economy of the Northeast. Many data were available and several excellant secondary sources have been produced. All evidence-number involved, percent of population involved, and value of remittances-points to the major contribution that employment in Western Europe made to the economy of the Northeast. But we had information that labor emigration from the region dated from before the protectorate and had involved large

numbers of men by the 1930's. Thus it was nothing new. The question we wished to answer was whether the relative impact of working in foreign countries was greater in the 1960's than it had been in the decades before independence. Data on the size of the regional economy were simply not available and thus we could not answer the questions. But again the general configuration is quite clear. Labor in foreign countries and the income generated by this labor that was spent in the Northeast was highly significant from 1930 to 1978 with the first years after independence representing short term exceptions.

While the impact of labor emigration may have been of the same order of magnitude in the 1960's compared with the 1930's and 40's we must point out that remittences affected the impact of the irrigation project. One of the reasons for its success was that demand kept up with increase in the supply of agricultural product. Without remittances continuing to come into a region that had for decades been dependent on them, demand may have fallen off to a point where incentives to increase agricultural production (given the poor means of transportation to other regions of the country with a significant population) would have been reduced significantly.

Analysis of the Recent Past

Because all evidence points in the same direction, detailed time series data while desireable, are not necessary to establish the direction of the long term economic change in the region up to the 1950's when irrigation began. But assessments of the changes in

production and productivity and the benefit-cost analysis required specific data on land use, costs of production and prices from the immediate pre-irrigation period right up to 1978. For the period before 1968 there are virtually no original sources. In archives we found a few reports done by Colonial Administrators before 1956, and some reports prepared by provincial governors after independence. The most valuable source was the Avant Projet done for the National Immigration Office. This report is dated January 1965, but the field research had been done in 1963-64. The study teams also had access to documents from an earlier period which are no longer available. We could not locate a complete set of the Avant Projet in Morocco in 1978, but fortunately a member of the study team had been given the complete set in 1970.

While there was some raw data reported for the late 1950's and early 1960's in the Avant Projet, there were not enough to redo the analysis. Therefore on matters like the area denoted to specific crops before 1956 and net returns per hectare we were forced to accept the conclusions reported. From 1968 on there were good data on yields, prices, land use, and cost of production, etc. available at ORMVAM. In those instances where we could compare data from ORMVAM with that collected in our survey we found a remarkable agreement. For example, the average expenditure per hectare per year reported by the farmers for water was almost exactly the same the average receipt per hectare, per year computed from ORMVAM's data. When appropriate

we could project backwards from this trustworthy data to check on that from earlier periods. For example, there cannot be great annual changes in the numbers of hectares planted in mature citrus, and increases in amount of land in mature citrus must be compatible with data reported for the previous year. These kinds of projections and consistency checks helped us not only to throw away data that were obviously wrong, but also identify sources that tended to be the most reliable. For example, if a source for 1962 reported a figure for total hectarage of mature citrus that fit with our backward projections, we would trust this source's report of prices received for citrus more than we would trust price data from a source that had reported a quite unreasonable figure for the amount of land in mature citrus.

A word is in order about our more general orientations to data from institutional records. Data, whether collected intentionally for specific purposes or on a day-to-day basis as part of a regular routine without immediate objectives other than to keep records, is always the product of a distinctive institutional process, itself to be understood in terms of its wider social context. The quantity and quality of any data, its areas of strength and its areas of weakness, always reflect this institutional process and the wider social context. ORMVAM data were available in almost unmanageable quantities, being collected both as part of a regular 'record keeping' process for management purposes and also, although to lesser extent,

as a product of specific investigations for evaluation and monitoring of particular activities. Within the corpus of data as a whole, considerable discrepancies were identified between sets of data collected by different branches of the ORMVAM or at different levels but relating to the same information. Data produced at the level of the CMV, for example, sometimes failed to agree with data produced by the central office of ORMVAM both in a dis-aggregated and aggregated form when we ourselves aggregated the CMV level information. Some of the discrepancies could be identified as the result of simple error (in copying, adding, etc.); others were the result of slight differences in the frame of reference (as when figures for area under crops related to slightly different time periods, although the difference was not made explicit); but sometimes no explanation could be found, either by ourselves or by ORMVAM officials when their attention was brought to the problem. We have no reason to believe, however, that any deliberate distortions had been introduced in these data. Generally, where information was of a high level of importance to the management and operation of the ORMVAM, it was generally good. Where it was collected as a by-product of other activities and there was no immediate perceived use for it, other than as a record of activities carried out and as evidence of the continuing endeavours of the relevant institution (CMV, branch of the ORMVAM, or ORMVAM as a whole) for higher authorities, it was frequently unreliable and incomplete.

Much the same general observation could be made for secondary

data examined in other state institutions and departments. The quality of data reflected the operational priorities of the institution or department concerned. Where data collection was simply routine, or had no clear purpose for those responsible for data collection and presentation, it tended to be patchy, inconsistent and unreliable in certain (often, for the purposes of this evaluation, crucial) respects. Furthermore, it was found that, only where a particular set of data was identified by the institution or department concerned as being of particular interest to some specific audience was it clearly and systematically organised and filed. Insofar as the operation of most state institutions and departments is a matter primarily of internal hierarchical concern the presentation of data in systematic form tended to be a function of a specific demand from higher echelons for a particular set of information, itself often an immediate response to some urgent but discontinuous pressure. For example, the twice-yearly reports produced by the provincial administration in both Oujda and Nador, as a record of economic and social activities within the province, do not consistently cover the same subjects or topics from period to period, thus making it extremely difficult to obtain systematic time-series information for any given subject. But by using multiple sources and checking for consistancy we developed what we believe to be a reliable set of quantitative data from the mid 1950's to late 1970's.

The Survey

The data available from ORMVAM and other institutional sources were indadequate in two regards: (1) They were limited almost exclusively to economic considerations (2) they were aggregated at least to the level of plain and usually to the total parameter. As the impact of the project is more than just economic and because different kinds of households were probably affected differently it was necessary to undertake a household survey.

The exigencies of field research affected our survey plans in several important ways. To understand what we did, it is necessary to understand what we wanted to do and could not. Because of our earlier work in the region, we were aware of the great heterogeneity. We had neither the time or the resources to undertake a survey on a large sample nor were we fully aware of what might be appropriate sub-samples to draw. We thus decided before going into the field that we would do two rounds of interviewing. We would first administer a relatively short questionnaire to a sample of about 300-400 heads of household, including some dryland farmers. This would get at size of holding, nature of tenancy, crops grown, income, off farm employment, family size, place of origin, etc. The plan was to do a preliminary analysis of the responses in the field to identify certain characteristics of the population. From this analysis sub-groups would be identified and small samples would be selected from these subgroups for intensive study. Detailed information or production,

prices, marketing, household consumption, family history etc. would be gathered in the second round.

In order to undertake field research in Morocco it is necessary to have the permission of the provincial governors. The governors will not grant approval until they have been officially informed by the Minister of the Interior that the research is sanctioned in Robort.

In June of 1978 Seddon and Purvis traveled to Rabat and among other things reminded USAID/MOROCCO of the importance of immediately seeking approval from the Interior Ministry for the field research. In July Purvis repeated the request and was assurred that matters were proceeding. In mid-August members of the field research team stoped in Rabat on the way to the Northeast. They sought assurances from USAID that Ministry of Interior authorization had been granted.

Something, however, went wrong. When pilot testing of the questions to be used was completed in September, the governor in Nador and Oujda had not yet received notification of the project from Rabat. The Governor of Oujda did not hold up field work, but the Governor of Nador would not permit any detailed field research until he had received a letter from the Minister of the Interior. When repeated inquiries to USAID in Rabat shed no light on reasons for the delay, it was clear that an alternative research strategy had to be developed. Two rounds of interviewing would not be feasible, so a plan for a single questionnaire had to be developed. All types of field research

would have to be concentrated on the right bank in September and October -- even those aspects of the work the most efficiently could be done later in the field work period. Plans had to be made for interview work on the left bank when authorized. While this change disrupted the well developed plans for proceeding systematically and efficiently, and made it impossible to complete certain aspects of the work, it was fortunate the change was made. Less than one month of field work time remained when permission to work on the left bank was received.

The survey had two major purposes: (1) to collect data on the impact of the project on the welfare of the household. (2) to collect data at the household level on production, productivity, farming techniques, and marketing. Questions were incorporated, therefore, which related to: 1) details of land ownership and use involving the relationship between landownders, farmer and workers, and the contribution and receipts of each individual providing inputs to the farm; 2) production data including inputs of land, labor, machinery, seed, fertiliser, pesticides and water, and outputs in volume and value (if sold) for all crops and livestock; 3) flows of funds into and out of the farm household (e.g. sources and amount of income into, and objects and amount of expenditure by, the household as a budget unit) and the nature of the economic and social relations associated with these flows; 4) the marketing of inputs and output from the farm, including prices of commodities, timing and location of sale,

type and cost of transport, and nature of relationship with the purchaser or seller; 5) the history of economic and social activities of present members of the household unit, including parents and siblings of the head of households, and relating to their occupation, residence and income at various time periods in the past; and 6) the relationship between the farm and the ORMVAM in terms of advice, credit and the provision of other inputs. (Copies of the questionnaire were deposited at USAID/Morocco in the Fall of 1978 and sent to USAID/Washington in the Spring of 1979.)

We were concerned with two types of error: sampling error and measurement error. The former was much easier to deal with.

There are two types of sampling errors: random error and systematic error. Given the level of precision required and the fact that we could in some instances check data from the questionnaire against data from other sources we felt we could tolerate some reasonably high amount of sampling error but would not know how to interpret the findings if there were a considerable amount of unknown systematic error. Thus we opted for a relatively small sample drawn by an impecable random technique. (The time constraints imposed by the forced change in strategy in any case restricted the size of the sample.)

Four samples were drawn. One of the farm households from each of the three plains and one of dry land farmers. A complete enumeration of all farmers in the irrigated area was provided by ORMVAM and randon

numbers were used to draw a 2.5% sample from the Triffa and a 3.5% sample from both the Sebra and the Bou Areg. Ninety-five heads of household were interviewed on the Triffa, thirty on the Sebra and forty-one on the Bou Areg. The first two samples are precisely 2.5% and 3.5% respectively. We should have interviewed 60 on the Bou Areg but the delay in getting started on the left bank meant we simply ran out of time.

Sampling the dry land farmer was a more difficult problem. There were two purposes for studying dry land farmers in the region. One was to gain an understanding of dry land farming in the late 1970's to get some clues on what the region would be like if there were no irrigation. The other was to discover if the potential for a symbiotic relationship between irrigated and dryland farmers was being developed. Sampling was a problem because one cannot identify the population one wishes to sample. It was pointed out in the body of the report that before irrigation the plains were a bad place for cultivation and that the best potential for rainfed agriculture was in the hills. Therefore, by and large, the dry land farmers remaining occupy land that is better for dry land farming than the present irrigated land and would provide a poor basis for estimating what the region would be like without agriculture.

We solved the problem by identifying eight douars that were located on the periphery of the irrigated land on each of the three plains. Twenty farmers were then randomly chosen from among the

households in these douars. These farmers had land that was most like the plain before irrigation. Because of the proximity to the irrigated region they also had the best opportunities for cooperation with farmers on irrigated land.

Possible measurement error was of greater concern than sampling error. We knew we would have no experienced interviewers at our disposal and thus interviewer error would pose a problem. We were also working in three languages. The farmers spoke Arabic (although there was the possibility that some were Berher speaking); many of the techinical reports done by ORMVAM were in French, and our report had to be in English. Error could easily occur in translations.

We were also concerned about farmer responces. Some might be reluctant to provide frank answers. If they thought we represented some official agency, for example, they might withhold accurate information or income or transactions in land. Even if there were no motivation to be less than candid, there might be problems in providing accurate answers. The average formal education of heads of household was only one or two years; some would be illiterate. With what kind of accuracy could they recall such things or the amount of fertilizer they applied to each crop over the year's time and the amount paid for fertilizer.

In order to keep measurement error within tolerable limits a number of steps were taken. Immediately upon arriving in the field questions that had previously been worked out were assembled in a test

questionnaire and pre testing began. We learned how to ask questions in such a way as to insure accurate responses.

At the same time we began recruiting and training interviewers. As we needed interviewers who were fluent in both French and Arabic, we selected ten lyceen from Berkane. They worked with members of our field team on pretesting and later did some initial interviewing with a member of the team. The shift from two rounds of interviewing to one delayed getting into the field and also made the questionnaire a longer, more complex instrument which took more time to administer.

The effect was that when the student interviewers had to return to school in October the survey was less than half completed on the right bank. We had, however, been recruiting and training additional interviewers, and by early October had a knowledgeable and accomplished set.

The questionnaire was administered in a manner to catch error quickly. An appointment was made with the designated farmers in advance. (Only one refused to be interviewed.) Each interviewer interviewed only one farmer a day. (Up to six hours were required for an interview) Each interviewer returned to the office in the afternoon and the answers he recorded were gone over by a member of the field team. If there were ambiguities or interview inconsistencies, the interviewer was sent back to check-out the problem.

The questionnaire was prepared in French (the never was an English version). The bilingual interviewers asked questions from the French version in Arabic and recorded answers in French. When members of the field team went over each set of responses at the end of the day, the clarity of the answers when considered in English was checked.

The result of this process was to keep measurement error to a minimum. When the interviews were being coded, for example, there was a rarely a case in which the meaning of the response was not clear or where the discrepancies and internal inconsistencies cost doubt on the accuracy of the response.

Error was also reduced by undertaking a preliminary coding in the field. Plans were to do all coding in Morocco before the end of the field work. Interviewers were to help in this task. But qualities that made for good interviewers did not make for good coders. This plus the fact the enormous heterogeneity in the data made it difficult to establish standard formats before the survey was complete. (We had, for example, anticipated some large families, but had not anticipated households with over fifty members). We thus divided coding into two stages. The first which was done partly in Morocco was to convert answers into codes and standard quantities and the second, done in England, was to place these codes in a standard format on code sheets. The fact that this initial coding step was done in Morocco meant that any problem of interpreting the responses could be checked out, if

necessary, by going back to the farmer.

As mentioned above, we did have an external check on the accuracy of our data. We could aggregate data as such thing as yields and amount of water used and compare them with ORMVAM's figures. For reasons mentioned in the main report some differences would be expected, but by and large they were remarkably similar. We believe the report is written from a remarkably accurate data base.

State Farms

The report does not deal with state farms. This is unfortunate, because the state farms played such a significant role in bringing former colon farms under Moroccan control and they represent such a striking managerial contrast with most of the private farms.

This neglect was not deliberate. The state farms required a very different approach than did the private farms. They were large bureaucratic operations which have a tendency towards a certain secrecy and which can produce a great deal of paper. The headquarters were in Rabat where some of the records were kept.

Because of the change in field work plans caused by the delay in research on the left bank, research on the state farms began late. Some information was hard to get and the team left the field with only the most sketchy data. A Moroccan who worked with the project agreed to collect the additional data (some of which would be available in Rabat). When the data arrived they were so sketchy and riddled with inconsistancy that we could not do any meaningful analysis.

The contract provided that following review in Morocco of a draft report some members of the research teams would go to Morocco to discuss revisions. We had planned to use this trip to collect some additional data. We knew exactly what we needed to resolve the problem of understanding the state farms and needed only a few days in Morocco. For reasons that were never clear to us, this trip was cancelled. Thus we were unable to complete the research on the state farms. There was also several other topics on which a few days in Morocco in the Spring of 1980 would have helped clarify.

The Benefit Cost Analysis

The Benefit Cost Analysis was undertaken using a very standard methodology. The data came from the sources described above. The assumptions that were made on such matters as sunk costs, projected life of project, and cost of money were discussed in Chapter three of the main report.