MONITORING, VERIFICATION AND EVALUATION UNIT
AGRICULTURAL POLICY REFORM PROGRAM

PLAN FOR ASSESSING THE IMPACT OF EGYPT'S AGRICULTURAL POLICY REFORM PROGRAM

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Impact Assessment Report No. 1

March, 1998

Sponsored by:

Government of Egypt, Ministry of Agriculture and Land Reclamation

United States Agency for International Development/Cairo
Office of Economic Growth, Agricultural Policy Division

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USAID Award 263-C-00-97-00003-00

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APCP	Agriculture Production and Credit Project
APRP	Agriculture Policy Reform Program
ATUT	Agriculture Technology Utilization and Transfer
CAAA	Central Administration of the Agricultural Affairs
CAAE	Central Administration for Agriculture Economics
CAES	Central Administration for Economics and Statistics
CAPI	Central Administration of Planning and Information
CAPMAS	Central Agency for Public Mobilization and Statistics
CATGO	Cotton Arbitration and Testing General Organization
CGE	Computable General Equilibrium
CLFF	Central Laboratory for Food and Feed
CSPP	Cotton Sector Promotion Program (GTZ funded)
DEPRA	Development Economic Policy Reform Analysis Project
DHS	Demoghraphic Household Survey
DRC	Domestic Resource Cost
EAS	Economic Affairs Sector
EASM	Egyptian Agricultural Sector Model
CBE	Center Bank of Egypt
EIHS	Egypt Integrated Household Survey
EOP	End Of Project
EPIQ	Environmental Policy and Institutional Strengthing IQC
ERSAP	Economic Reform and Structural Adjustment Program
FSR	Food Security Research
GAMS	General Algebraic Modeling System
GDP	Gross Domestic Product
GIS	Geographic Information System
GOE	Government of Egypt
GPS	Global Positioning System
GreenCOM	USAID Project to assist MPWWR
GTZ	Deutsche Gesellschaft Fuer Technische Zusammenarbeit
IBRD	International Bank for Reconstruction & Development
IBTCI	International Business and Technical Consultant Inc.
IDSC	The Information and Decision Support Center
IFPRI	International Food Policy Research Institute
IHS	Integrated Household Survey
IMF	International Monetary Fund
IQC	Indefinite Quantities Contract
IRRI	International Rice Research Institute
KAP	Knowledge Attitudes & Practices
LS/ELS	Long Staple/Extra Long Staple
LSMS	Living Standard Measurement Survey
LW	Land Water
MALR	Ministry of Agriculture and Land Reclamation
MPWWR	Ministry of Public Works and Water Resources

MTS	Ministry of Trade and Supply
MVE	Monitoring, Verification, and Evaluation
NLDS	New land Development Study
PAD	Percentage Absolute Deviation
PBDAC	Principle Bank for Development and Agriculture Credit
PSU	Primary Sampling Unit
RDI	Reform Design and Implementation
RMG	Ready Made Garments
SAM	Social Accounting Matrix
SIC	Standard Industrial Classification
SO1	Strategic Objective No.1
STTA	Short Term Technical Assistant
TFP	Total Factor Productivity
USAID	United States Agency for International Developmenet

ACKNOWLEDGMENTS

The impact assessment team wishes to thank many parties who contributed their time, insights and comments to the team's efforts to produce a comprehensive report. These parties include the following:

- the various APRP Units and partners — RDI, FSR, PMU, EPIQ, Greencom.
- USAID officers managing the APRP portfolio. Mohammed Omran and Glenn Rogers deserve special mention.
- PPC members, particularly Dr. Saad Nassar and Dr. Hamdi Salem.
- various GOE managers in the MALR, MPWWR, CAPMAS, and MTS.
- technical advisors on other USAID funded projects, such as DEPRA, ATUT and the IBTCI Monitoring and Evaluation Contract for Privatization.

Thorough, in-depth reviews of earlier drafts of this document were provided by MVE COP Gary Ender and Glenn Rogers. Akhter Ahmed offered detailed comments on those sections relating to FSR's research activities and data sets. Dr. Ahmed also made a special presentation on the Egypt Integrated Household Survey data set at MVE's request that provided useful background information and detail. Mohammed Omran and Max Goldensohn also reviewed earlier versions of this report and provided helpful comments.

The team's field visit to two governorates in the Delta was a success due largely to team member Morsy Ali Fawzi's efforts. He received excellent collaboration from the MALR Sampling Division and field MALR officers.

In the course of the team's mission and in follow-up discussions within APRP and with USAID, the MVE Unit became convinced that RDI and FSR have committed to work closely and collaboratively with MVE in doing studies that contribute to impact assessment. The analytical agenda is clearly vast, and their help and input is most welcome.

PREFACE

This report is the first in a series of impact assessment outputs of the MVE Unit of APRP. It represents the collaborative effort of three expatriate consultants, two local consultants, and two full-time staff of MVE. Other members of APRP contributed their time and ideas to the report as well, particularly MVE COP Gary Ender, FSR COP Akhter Ahmed, and the entire RDI team.

The term *impact assessment*, preferred by MVE over the more commonly used *evaluation*, refers to how the complex sectoral program of policy reform, APRP, affects the output, incomes, employment and investment of farmers, domestic traders, processors, importers and exporters. The welfare of rural and urban consumers is also a key consideration.

Impact assessment is one of three major activities of the MVE Unit; the other two are verification and monitoring. APRP is one of several large USAID programs that affect the welfare and productivity of agricultural producers, private and public agribusiness firms, and consumers. Disentangling the effects of APRP from those of other related programs, such as SPR and ATUT, is a difficult challenge.

This report presents practical recommendations for assessing the multi-faceted impacts of the APRP Program. Within the budgetary resources of the MVE Unit, and given the limitations of available GOE agricultural and economic data, it addresses many of the potential impacts of relevance to APRP, the GOE and USAID.

The report strikes a balance between subsector studies plus specific regression analyses and more formal modeling efforts. The former are easier to do and are likely to have an analytical payoff. The modeling activities, while more comprehensive and theoretically valid for analyzing with-and-without scenarios, are also higher risk, data intensive, and not always easy to validate and calibrate with accuracy to the actual Egyptian situation.

This report is a planning document. The report provides an impact assessment framework, as well as many specific recommendations, that will surely prove to be very valuable. Implementation of the plan may differ in some details from what is laid out in this report, depending on data availability, changes in priorities for research and analysis, and emerging policy issues.

EXECUTIVE SUMMARY

The Egypt Agricultural Policy Reform Program (APRP) funded by USAID has as its broad goals increasing Egypt's economic growth through opening agricultural markets, privatizing agricultural markets and agribusiness, improving the efficiency of Egypt's water resources, restructuring agricultural support services and targeting food subsidies. The purpose of this report is to lay out a plan to guide the Monitoring, Verification and Evaluation (MVE) Unit in assessing the impact of reforms implemented under the project, and to isolate the effects of APRP reforms as much as possible.

This plan was prepared by a seven-person team consisting of two permanent employees of MVE, three expatriate and two Egyptian consultants, all agricultural economists. Field work for the study took place in Cairo between October 4-24, 1997, and consisted primarily of reviewing documents relating to previous and ongoing studies by APRP operating units, reviewing questionnaires relating to some of these studies, and meeting with numerous USAID and Egyptian officials and researchers who are knowledgeable about one of more of the studies or other aspects of the APRP. The report has benefited from substantial comments by MVE and USAID staff.

A correct assessment of impact of the APRP requires a comparison of results *with* the reforms versus what would have occurred *without* them. This requires utilizing an approach that facilitates sifting out the impact of investments in research and extension, new investments in technology, development of new lands, changes in world prices, foreign aid, residual impacts of the predecessor Agricultural Production and Credit Project (APCP), etc., from the impact of APRP reforms. To accomplish this the planning team recommends a combination of targeted studies and utilization of selected modeling techniques aimed at the most important markets and APRP reforms.

These studies and modeling exercises will be aimed at the most important markets and activities affected by APRP reforms. They will build on studies and modeling exercises conducted by other APRP units and other projects in Egypt. The effect of the reforms on crops and subsectors that are not studied in detail will be picked up by adapting the agricultural sector model, and by developing a new multi- market model to handle the effects of the reforms. Other studies will provide an estimate of impacts policy makers wish to follow that are not picked up by the models.

The key to successfully combining modeling techniques with more targeted special and subsector studies to assess the impact of the reforms is in correctly tracing through the causal effects of the reforms, including negative as well as positive impacts. With many variables and policies relating to a given subsector changing at the same time, often in conflicting directions, specification of causal chains and impacts is, at best, difficult and imprecise. Markets are being constrained by conflicting and contradictory policies. These effects have to be summarized in one or two measures per subsector to be fed into the models. The models, in effect, abstract from the detail unveiled through the targeted studies. In so doing they gain the advantage of being able to examine a wider range of impacts at other levels.

To assess impact the planning team recommends focussing on eight variables: changes in agricultural production, changes in total factor productivity, changes in market structure that lead

to changes in marketing margins, changes in employment, changes in producer and consumer incomes, changes in the GOE budget, changes in participation of the private sector in key subsectors, and changes in the regional composition of income. These eight variables focus mostly on ultimate impacts of APRP rather than on the progress of the reforms as do the USAID R4 indicators. However, as Table 1 shows, the two sets of measures are related and can be tracked together.

The topics and subsectors meriting priority attention in the evaluation effort are those that we believe are most important for broad-based growth and development in Egypt's agricultural sector today and in the near future. In general, these are the same areas where APRP is concentrating its efforts; they include cotton, farm cropping patterns, input use and productivity, fertilizer, private agribusiness and food security. Wheat, rice, water resource use, horticulture, maize and livestock would receive less attention from MVE because other APRP units are devoting substantial resources to these subsectors, or the models should capture most of the effects. Nonetheless, MVE needs to work closely with these other units to ensure that the data they collect meets the needs of the impact assessment.

To define the specific studies that need to be undertaken, the planning team recommends that MVE begin with a series of subsector status reports. These reports will review studies relating to the subsector that have already been completed or are underway; report what is currently known about the subsector, based on these studies; if possible, identify specific measures of impact that appear meaningful for the subsector in light of the reforms and the studies; and identify what additional information is needed, if any, to specify those measures or establish baseline values for them, as the case may be. The highest priority need is to identify what specific indicators or variables MVE will use to measure impact — not classes of variables but specific variables, e.g. which margins, between which varieties, products or intermediaries, in which markets, at which time of the year, for which purpose.

Each of these subsector studies will take approximately four weeks and require the person conducting the study to get into details of what is known about the structure, conduct and performance of the subsector, available secondary data sources, what kind of data files are available from studies, and how suitable they are for providing data for the measures of impact that APRP staff agree to use. Each study should propose the specific variables that will serve as measures of impact, how they will be applied to those products or relationships in the subsector that will be measured, how they will be interpreted for impact assessment purposes, and most importantly, how they will be estimated, both for baseline and end-of-project values. Unless MVE confronts this degree of specificity now, there is a good chance of not having adequate data at the end of the project for assessing impact.

The targeted studies indicated as necessary by the subsector status reports will provide a more complete understanding of the structure, conduct and performance of specific subsectors, trace causality, identify baseline measures of key impact variables in the subsector, provide technical coefficients for preparing analytical models, and provide estimates of potential impact required by the models for predicting, *ex ante*, the impact of specific reforms. Although such studies cannot easily take into account the effect of changes in one subsector on another, they are relatively easy to conduct and are readily understood. With proper qualification regarding the precision of measures of impact and the presence of spillover effects, they can be as useful as

more sophisticated modeling techniques in assessing the impact of the reforms. More importantly, they have a high probability of successfully identifying critical impact variables and how those variables change over time. Similar studies at the end of the project will document the extent to which the expected changes actually occurred, and identify other changes which appear to arise from the reforms.

In addition to the subsector status reports, the planning team recommends studies of allocative and technical efficiency, an attempt to estimate supply elasticities from the IFPRI-EIHS data; in collaboration with GreenCOMIII assessing changes in knowledge and attitudes toward water supply; and continuing the excellent collaboration that exists between the various units of APRP with respect to planning and executing studies.

The implementation plan calls for baseline studies (filling in what the subsector status reports show to be lacking) for fertilizer, cotton, rice, wheat, food security, privatization, allocative efficiency and water use efficiency within irrigation systems. It calls for MVE to collaborate with RDI in collecting data for the EASM, as well as developing its own multi-market model. It recommends a shift-share analysis of MALR time series crop production data, assuming the evaluation of its quality indicate the data can support this type of analysis.

The complexity of interactions from a national perspective makes it very difficult to trace through the impact of specific reforms with subsector studies alone. Models can be quite helpful in converting causal chains into quantitative measures of program impact across the entire agricultural sector.

The modeling techniques proposed by the evaluation planning team include regression models for evaluating changes in factor productivity and allocative efficiency and for identifying relationships between variables that are related to each other in spatial, temporal or other ways. They also include utilizing the Egyptian Agricultural Sector Model (EASM) for identifying allocations of resources that maximize the real value of agricultural production and welfare across all agricultural markets. The EASM is being updated by RDI. Finally, we recommend developing a multi-market model for analyzing changes in producer and consumer welfare in a broad, intra-sectoral context, and for separating the effects of the APRP from other influences. This model does not currently exist and would be developed by MVE.

Building a meaningful model takes a great deal of time and good quality data. Moreover, the accuracy of the models is proven mostly in retrospect, after it may be too late to utilize alternative approaches. For this reason we see the more sophisticated modeling techniques (EASM, multi-market model) as providing a higher risk, potentially higher payoff strategy. They are, thus, suitable as a component of a broader impact assessment strategy, but should not be relied upon as the primary source of information for assessing impact.

The report discusses how to use the various models for assessing impact, and provides details on their development. The EASM will be updated by RDI for use in ex-ante assessments of the impacts of certain proposed reforms. That model already contains considerable detail and sophistication for doing this, and RDI analysts have experience in using such models. With RDI taking the lead MVE may be able to use the model to get good end-of-project estimates for assessing impact with a relatively modest input in planning.

To measure the impact of the reforms across subsectors, and to get a more comprehensive estimate of their effect on producer and consumer surplus and on the GOE budget, we recommend that MVE take the lead in developing a multi-market model. The work required to do this is reduced considerably because MVE will be able to take advantage of the work underway in the FSR on demand systems estimation and in RDI (with MALR, MPWWR and MTS) on updating and expanding the EASM. Unlike the EASM, the multi-market model fully integrates production and consumption decisions, and incorporates feedback from income changes on consumption and production patterns across subsectors.

To produce reliable results models need large amounts of fairly accurate data. Appropriate data may or may not be available in Egypt; some of what is available may be of poor quality. Until a proper assessment of data availability and quality can be made, MVE should not make a definitive determination of what future studies it will undertake or which models it will develop.

The Egypt Integrated Household Survey gathered production as well as consumption data, but there are questions regarding the level of detail that was recorded on the questionnaires. It may not be possible to use that data to estimate supply elasticities for the multi-market model. This is another argument for encouraging updating the EASM; it can produce supply elasticities from reasonable good synthetic input-output data.

For another source of data on input use and crop production technologies, we suggest MVE conduct an evaluation of the quality of data collection by MALR extension agents at the same time it evaluates the suitability of the EIHS production data. There appears to be a well developed and sophisticated system for recording input-output data on the four major crops. It merits a look to see whether this system can be modified to obtain good data on other important crops for building the models.

The table on the next page is a reproduction of Table 3. It summarizes the preparatory analyses MVE needs to do before deciding on a definitive impact assessment plan. It shows how the results of those analyses bear on the types of studies and modeling exercises that might follow.

DECISION TREE FOR MVE SURVEYS

1- Evaluate FSR/EIHS demand elasticities for multi-market model and income impact studies. If OK, go to 5, if not 2	Evaluate quality of FSR/EIHS production data for suitability for:	Conduct study of coverage, quality and suitability of MALR and CSPP production and input data for	Complete subsector status reports for cotton, wheat, rice, cotton, fertilizer, and food security.
2- Contract with CAPMAS for demand elasticities.	- Baseline measures for production data and input use. - Estimating supply elasticities. - TFP Analysis. - Input-output data for EASM. - Shift-share analysis. - Obtaining end-of-project production and input data.		- Identify market structure and policy reform issues requiring added study. - Identify specific measures to use for assessing impact. - Establishing baseline values for impact measures. - Identify additional data needed to establish baseline. - Identify additional studies to understand market performance and assess impact of reforms.
3-	Conduct additional survey to get baseline production and input data if necessary.		Conduct surveys required to obtain missing baseline data. Conduct/collaborate on remaining studies of fertilizer, cotton, rice, wheat, agribusiness, employment for understanding sub-sector and impact of reforms.
4-	Update EASM, produce supply elasticities for multi-market model if necessary. Develop and run model for TFP analysis.		Continue to monitor changes in baseline measures for impact variables. Analyze nominal protection coefficients.
5- If data are forthcoming, develop and test multi-market model.	If data are suitable, prepare shift-share analysis.		
6-	Obtain end-of-project production and input data using method chosen in 2 above.		Conduct surveys to collect end-of-project data for priority subsectors.
7-	If necessary, recalibrate the EASM and rerun with end-of-project data.		Complete subsector impact assessments using data from targeted studies.
8- Recalibrate multi market model, if used and necessary prepare end-of-project run.			

1. CONTEXT OF THE IMPACT ASSESSMENT EFFORT

The Agricultural Policy Reform Program (APRP) funded by the U.S. Agency for International Development (USAID) has as its broad goals increasing Egypt's economic growth by opening agricultural markets, privatizing agricultural markets and agribusiness, improving the efficiency of Egypt's water resources, restructuring agricultural support services and targeting food subsidies. The purpose of this report is to lay out a plan to guide the Monitoring, Verification and Evaluation Unit (MVE) of the Project Management Unit in assessing the impact of reforms implemented under the project, and to isolate the effect of APRP reforms as much as possible.

Reforms promoted under this project reinforce reforms in the agricultural sector and in other parts of the economy being promoted by USAID, IMF, IBRD, the Dutch and, no doubt, numerous other donors. Even though APRP involves expenditures of $250 million over five years, USAID and other donors are providing several billion additional dollars for the purpose of eliciting similar or related reforms. In all likelihood there is substantial complementarity and overlap between the reforms being promoted by the various donor programs.

Because of the presence of these other substantial influences on the course of the Egyptian economy over the period of APRP, and because overall economic growth, or the lack thereof, will continue to be affected by numerous other factors, a correct assessment of impact of APRP requires a comparison of results *with* the reforms versus what would have occurred *without* them. This is distinctly different from comparing the situation *before* the reforms to the situation that will exist *after* the reforms. The latter approach would, in effect, attribute all change, including that caused by investments in research and extension, new investments in technology, development of new lands, changes in world prices, foreign aid, residual impacts of the predecessor Agricultural Production and Credit Project (APCP), etc., to APRP reforms.

In this respect it is, perhaps, more realistic to speak of apportionment rather than attribution when the impacts cannot be clearly traced to the reforms. This will require a great deal of guesstimating as to the share to apportion to APRP. Alternatively, APRP could be combined with non-APRP assistance and the two assessed together, perhaps over different time periods according to the sequencing of those other assistance programs. In this proposed plan we are optimistic that some of the modeling techniques which we propose will do a good enough job of separating impacts that only apportionment will be necessary, and that should be able to be done using fairly hard estimates of total impact.

1.1 USAID Strategic Objective Reporting Requirements and Other Indicators

The purpose of APRP is to promote USAID/Egypt's Strategic Objective to "Increase Private Sector-Led Export Oriented Economic Growth" in Egypt. Accordingly, the plan for assessing the impact of APRP should serve both the reporting requirements of USAID with respect to its broader development agenda, as well as provide MVE with data it needs to assess the impact of APRP. This presents a considerable challenge. Progress reporting necessarily must focus on more easily measured and more immediately available indicators, many of which are *assumed* to be correlated with the program goal. Assessing impact, on the other hand, requires a more objective examination of how the reforms actually do affect target

groups, verifying that the assumed impacts are realized, and quantifying the ultimate extent of those impacts. Progress reporting requires fairly frequent measurement to ensure that reforms are having their intended effect in order to guide disbursement. Impact assessment, in most instances, requires only good before and after data. What happens in between is important mostly for identifying other influencing factors to exclude in order to isolate the impact of APRP reforms.

A useful way of distinguishing between measures of progress and measures of impact is to place then on a continuum developed by MVE: 1) policy benchmark, 2) indication of policy change, 3) indication of initial impact, 4) indication of further impact (if appropriate) and, 5) indication of ultimate impact. Many of USAID's R4 indicators fall toward the middle of this continuum. APRP impact indicators must capture the end.

This difference in purpose and content can be understood more clearly by comparing USAID indicators of progress with those suggested by Fletcher (1997) in his review of Tranche I benchmarks for APRP and those proposed by the impact assessment planning team. The USAID R4 lists approximately 16 indicators for the SO under which the APRP falls. Fletcher lists 51 policy surveillance and progress indicators. The impact assessment planning team proposes only eight measures, though generally at a higher level of aggregation than the others. These eight can be disaggregated to provide measures of some of the indicators required by USAID or proposed by Fletcher.

Table 1 compares these indicators, including only those of Fletcher which we consider to have a high or medium priority. The high priority set represent indicators that are more easily measured, less ambiguously correlated with USAID's program goal, more substantive in the magnitude of potential impact over the life of the APRP, and which provide a measure of ultimate impact as well as an indicator of progress. The middle priority group are more problematic to measure, are picked up by other indicators, or draw too much interest to drop. The low priority indicators are either too difficult to measure, would be too diluted if defined narrowly enough to measure, or are not expected to have much impact over the life of APRP. One particularly large group of Fletcher's indicators that we assign a low priority to are those improving essential supporting services and the institutional policy environment to make markets work better. Apart from better price reporting, most of these will not have a substantial impact on the assessment team's impact measures before the end of the project. Others involve definitional nightmares that make monitoring arbitrary at best, or relate to items that do not figure prominently in the work plans of the various APRP units.

Table 1: Comparison of USAID, Flecther and Impact Assessment Team Indicators

USAID Indicators	Fletcher - High Priority Indicators	Impact Assessment Planning Team Measures
1. Higher Level Welfare Indicators		
GDP growth	Growth in real income among poorest households	Changes in employment
Food prices	Falling proportion of rural households below poverty line	Changes in producer and consumer income by gender and income
Real income	Lower Gini coefficient for rural income distribution	
Private sector share of GDP	Increasing average income of rural population	Changes in regional composition of production and income
Percent of pop. below poverty level		
2. Increased Private Sector Exports		
Private sector share of non-petrol exports	Nominal protection coefficients close to unity	Changes in agricultural production of tradables
Value of non- petroleum exports	Rising volume and values of ag. imports and exports	Changes in regional production of tradables
Effective rates of protection		
3. Increased Productivity of Private Enterprises		
Real value of production per m^3 of water and/or land	Rising real output per m^3 of water used in agriculture	Changes in total factor productivity
	Price-induced changes in crop and livestock production	Changes in the regional composition of income
Value of policy reform disbursements	Higher proportion of farmers selling to private buyers	
Nominal protection coefficients for wheat, maize, rice and cotton	DRCs evaluated in market prices closely comparable to opportunity costs	
	Reductions in per unit marketing costs	
	Rising share of irrigation system operating costs paid by users	
	Reduction in PBDAC's employment level	
4. Improved GOE Support of Competitive Markets		
Number of privatizations	Decreased public sector role in input and product markets	Sustainable changes in market structure
Value of privitizations	Sale or liquidation of publicly owned distribution facilities	Changes in private participation in key subsectors
GOE budget deficit	Increase in the number and size of private agribusinesses	Changes in private participation in policy dialog
Public opinion on GOE progress	Increase in volume and share of private agribusiness sales	Changes in GOE Budget
Support for private involvement	Regular and timely availability of credible market information	
Increased participation in policy dialog	Growing utilization of futures markets and risk management tools	
	Not Clearly Assignable	
	Increased volume of lending to women	
	Food subsidies benefiting primarily poor households	Changes in the regional composition of income
	Fletcher - Lower Priority Indicators	
	Real exchange rates maintained at stable or declining levels	
	Decrease in gap between average rural and urban incomes	
	Benefit-cost analysis used to limit land reclamation to high return areas	
	Water user associations actively participating in policy dialog, planning and decision making	
	Innovative approaches to delivering extension to small farmers	
	Growing volume of non-farm rural lending by PBDAC and other private lenders	

In selecting the measures we feel most precisely measure APRP impact we have focused on variables that attempt to measure ultimate impacts, which are relatively few, rather than intermediate impacts which are relatively many and sometimes more dubious as to any substantial ultimate impact on consumer welfare and real incomes. The one impression that stands out in Table 1 is that USAID's indicators for the SO do not correspond well to the medium and long-term policy goals established for the APRP. It stands to reason, therefore, that it will be difficult to mesh the two sets of indicators completely. There is better correspondence with Fletcher's indicators of progress because the purposes of the indicators are similar.

It should not be surprising that the indicators are different in important respects, or that indicators aimed at impact assessment would be more comprehensive than those aimed at monitoring progress. Nonetheless, the three sets can be integrated to a certain degree. The remainder of this section describes our justification for selecting the variables we have, and shows how they relate to the USAID and Fletcher indicators, or go beyond them in order to get at ultimate impact.

1.2 Priority Policy Objectives and Beneficiary Groups

We have chosen for greater focus those subsectors that have historically been highly distorted by conflicting policies, affect large numbers of growers and agro-industries, provide substantial employment, or are important from a food security or cash income perspective. In looking at these subsectors we suggest focussing on three groups of policy objectives and three beneficiary groups. The groups of policy objectives are:

a) Liberalizing agricultural production , marketing, processing and trade;
b) Expanding the role of competitive private enterprise in the agricultural sector at all levels;
c) Developing targeted food subsidy programs.

The beneficiary groups are:

a) Farmers;
b) Consumers, especially low income consumers;
c) Private sector entrepreneurs, traders and businesses.

Each of the studies proposed in this plan bears directly on one of these policy objectives or groups of beneficiaries. These are also the objectives and beneficiaries that are receiving the greatest attention in the work plans of the APRP operating units.

1.3 Priority Measures for Assessing Impact

Appropriate measures for assessing impact will vary, at least somewhat, according to the medium/long-term policy reform goal and APRP objective to which they pertain. Some of the

impacts from the reforms will be more direct and more immediate. Others, while perhaps significant, will not be substantial within the three years remaining for the APRP.

1.3.1 Changes In Agricultural Production

This is the most direct and immediate impact of most of the reforms. Data to measure this appear to be available from the MALR within 12 months following the end of the crop season, perhaps earlier, though there remains some question of quality. Data from the Food Security Research (FSR) unit of the APRP may also be adequate for establishing a baseline for this measure. This indicator, thought not really an ultimate impact measure, has the advantage of being clearly understood by virtually everyone. Agricultural production will be measured as the total value of major agricultural enterprises using 1995-1997 average producer prices to value annual output. An alternative for valuing output would be to use estimated long-run export-parity prices for each of the commodities in a single year to weight production so that unusually high prices in one of the base years does not distort the real trends.

There is clear interest among many persons to follow changes in agricultural production by region. If statistically valid estimates are to be the norm, getting good data at the level of the Governorate or major Water Districts will increase required sample size by a factor of two or more, and still provide a significantly lower level of precision at sub-national aggregation levels. Moreover, sampling error from even a large, well executed national survey will swamp any likely change in production for most crops over a three year period. It would seem to be more appropriate, therefore, and equally reliable, to rely on MALR production statistics for all types of production at all levels of aggregation, and free the production studies to focus on input-output relationships for key technological packages for important crops. This could be done with smaller, more focused surveys that will be much less demanding on MVE and MALR resources.

This indicator can provide an estimate of how much APRP reforms are contributing to GDP growth, and using the modeling techniques described later, can monitor price induced changes in crop and livestock production.

1.3.2 Changes In Total Factor Productivity (TFP)

Increases in productivity enhance Egypt's ability to compete in world markets and strengthen the purchasing power of its consumers. Crude measures of productivity, such as the value of production per unit of land and value of production per unit of water, in effect, assign all of the change in output to a single input. While this is adequate for monitoring project progress, it leaves much to be desired for the purpose of assessing impact. A more precise formulation would seek to assign productivity to individual inputs in proportion to their contribution to the change. This can be done via a factor productivity analysis applied to an aggregate production function using annually updated data. Time series data available in the USAID agricultural database maintained by Dr. Mohamed Sherif Omran appear adequate to do such an analysis, but raise questions regarding suitability in the face of substantial structural reforms over the past several years. A better approach would utilize cross-sectional governorate-level data from the

MALR, again assuming the quality of the data can support this type of analysis, a matter we address later.

Whatever data series is used, an MVE consultant could prepare the initial analysis in collaboration with Dr. Fawzi Morsy of MVE, and Dr. Morsy could rerun it annually as new data become available. Another advantage of this method is its ability to reflect underlying trends in years when an abnormal disturbance causes total output to drop. How to measure total factor productivity is discussed in section 3.2.1.

A key question of interest both to GOE and USAID/Cairo is how the agricultural reforms are affecting the efficiency of private sector activity. Two key pertinent measures at the farm-level are allocative and technical efficiency. Farmers are allocatively efficient if they combine inputs in optimal proportions, which means that factor substitution rates are equal to the inverse of the negative of relative factor prices. Farmers are technically efficient if they are operating on their production functions, defined as the maximum possible output from a given level of inputs. Both of these measures of efficiency would be available from this analysis, as would the single variable measures of efficiency required by USAID and suggested by Fletcher.

1.3.3 Changes In Market Structure That Promise To Be Sustainable

Many of the objectives, benchmarks and indicators are stated in terms of increased participation of the private sector in marketing and processing. These are changes in structure. From the impact perspective what interests us, presumably, is the result of that structure, i.e., market performance. What we want is competitive behavior. Privatization does not always lead to competitive behavior; often a limited number of private firms capture the benefits of privatization through collusive or oligopolistic behavior, frequently with the knowledge and assistance of public officials.

The USAID indicators relating to the number and value of privatizations, and Fletcher's indicators relating to a reduced role of the public sector in input and product markets provide an indication of progress in changing market structure, but they are not easy to quantify so as to provide a measure of the actual impact of this increased privatization.

The impact of changes in market structure that improve market performance can, in many cases, be reduced to changes in marketing margins for commodities, inputs and final products, to more timely availability of inputs or sale of outputs, or to lower processing margins for agro-industries. MVE studies will provide estimates of margins and costs needed for measuring the impact of such changes in structure. Changes in the size of the margins or processing margins provide clear evidence of movement, or lack thereof, because of the reforms, and are readily measurable. Margins and costs respond fairly quickly to changes in market structure and should provide a useful measure of first order impacts of the reforms.

The impact of improved availability of inputs and markets for output due to changes in structure is more difficult to measure. The flow of benefits would be both in the form of increased income for farmers at the expense of middlemen, and increased income for farmers because they are able to shift their production functions to a higher level of output. There may also be a benefit to farmers and middlemen due both to reduced inventories and quicker turnover of capital. Measuring this benefit will require utilization of analytical models that cover the entire agricultural sector rather than a just one commodity.

1.3.4 Changes In Employment

Employment in agriculture, agribusiness, government and parastatals will change as a result of the reforms. However, the very source of the cost savings and productivity increases arising from the reforms is, in significant measure, due to reductions in public sector employment being greater than increases in private sector employment. For this reason MVE should monitor employment changes in both public and private sectors and take a specific normative position on how each will be treated in the impact assessment. Employment changes will also be fairly immediate.

MVE will need to ascertain whether employment data by sector is available in a reliable format before it can determine what data to collect and how. Our team was not able to verify the availability, aggregation level or quality of employment data, except for exporters. Since they are available by SIC category for exporters, we can only assume that similar data is available for non-exporting industrial and commercial employers, also by SIC category. If so, and if such data are regularly updated, simple tabulations of employment by SIC category would appear to be adequate for sector based reforms.

Employment has not received much attention from the APRP or USAID thus far, except for one of Fletchers' indicators regarding reduced employment in PBDAC. But it is precisely the fear of such reductions in employment that causes the GOE to go slow with many of the reforms. If MVE or RDI can show that employment expands in the private sector by a significant percentage of the amount by which it is reduced in the public sector, and if such changes result in increased incomes on an aggregate level, then it would seem reasonable that the GOE would speed adoption of the reforms. In this sense monitoring changes in employment may in and of itself increase the impact of APRP by increasing the pace of reform. For this reason this indicator merits the high priority we give it.

1.3.5 Changes In Producer And Consumer Incomes and Surplus

Clearly, both the Government of Egypt and USAID are interested in how the impacts of reform are distributed. Some tend to view income increases for agricultural producers and consumers as good and income increases for middlemen and processors as bad. In fact, the income benefits of all technological change in a freely competitive economy eventually pass to consumers. Producers and middlemen benefit only to the extent they can keep in the forefront of

technological change, or as the overall subsistence wage in the economy rises. In the short run, however, which is always the current situation in a growing economy, lack of information and skills result in some participants obtaining only a small share of the benefits. Reforms that change economic structure, rules and regulations can alter this.

Measuring changes in income for agricultural producers in Egypt is easier than for consumers. Production, cost and price data is forthcoming from the agricultural districts for crops, though not for livestock or off-farm employment. Except as the counter-effect of changes in producer incomes, measuring changes in consumer income requires sample surveys or models.

Surveys designed to measure changes in consumer income often are so small in size that large sampling errors make it difficult to say what has happened to incomes with much precision unless the magnitude of the change is substantial. This is not likely to be the case over a three or four year period in present day Egypt. Sector models, however, can produce an estimate of changes in producer and consumer surplus that is consistent with documented changes in cropping patterns and producer incomes. This seems the only reasonable way to measure the impact of the reforms on consumer income over such a short period. Such models can provide estimates of how much the reforms add to real incomes and GDP growth, as well as to exports, supporting those USAID R4 indicators.

1.3.6 Changes In GOE Budget

Reductions or lower growth in subsidies and public sector employment will reduce government deficits, while reductions in tariffs and export taxes will reduce revenues. It should be fairly easy to quantify the amount by which such items change. The difficult part will be in deciding what portion to attribute to APRP. A Multi-market model can help sort through the extent to which the reforms cause change in the GOE budget deficit. This modeling technique is described later.

The budget share allocated to food subsidies is a particularly sensitive issue. Pilot studies are being designed by the Ministry of Trade and Supply and FSR to examine food subsidy targeting alternatives. The Multi-market model can estimate, ex-ante, what effect changes in subsidies will have on incomes and the deficit.

1.3.7 Changes In Private Participation In Key Sub-Sectors and in Policy Dialog

This may be a substantial and desirable result of the reforms, but participation is not an impact that can easily be reduced to a least common denominator that allows combining it with other impacts. For this reason we suggest that MVE simply monitor the USAID indicators for this variable. Some measure of the number and percentage of private firms, and total employment in those firms for the four key sub-sectors should provide a useful measure of participation in markets.

1.3.8 Changes in the Regional Composition of Production and Income

USAID/Cairo is currently operating under the 1996-2001 Strategic Plan. Regional development with specific attention to poverty alleviation is one of the major focusses of this plan. Reforms that focus on water use, cotton, rice, sugar cane and horticultural production may have strongly differentiated regional impacts.

Separating impacts by region requires that samples for collecting data be considerably larger than for national level impacts, and that models be made more complex in order to generate and analyze data from a regional perspective. The present resources of MVE do not appear to be adequate to address this impact completely; but they can make a contribution to the analysis. One of the models we propose be used to attribute impact (EASM 94) is already structured to include five water management areas: five Nile Valley regions (Upper and Middle Nile Valley and three Delta regions) and three New Lands regions.

Some of the data for assessing impact will be collected specifically to address reforms in one of these geographical areas. Other data can be tabulated using these same groupings. The models, in particular, can be useful for this type of analysis because once the input and technology packages are identified for each region, the results are mathematically determined; there is no sampling error in the results. This allows researchers to put their attention on identifying representative input-output coefficients based on results from broader, statistically more representative surveys, without worrying too much about the large sampling error associated with the sample estimates for a particular region. In essence, when the regional sample is small the more representative results of the overall sample may provide a better guide for setting input-output coefficients for specific regions than the estimates derived from the sample itself for that same region. Remember, a representative sample does not assure representative results unless sample size is large in relation to the variability being measured. For sub-national disaggregation of samples of the size MVE can afford to use, the judgement of experience may well provide a better estimate than a mathematically calculated sample mean.

1.4 Challenges Confronting the MVE Impact Assessment Effort

MVE's impact assessment efforts face several challenges. A major one is the short time frame until the end of the project. This does not leave MVE much time for establishing baseline measures and following up with studies of how baseline variables are changing over the life of the APRP. Moreover, APRP benchmarks are being adopted in Tranches throughout the program's scheduled life so many impacts have not yet been identified or have not yet unfolded. Finally, there is the issue of controlling for the residual impact of APCP reforms, the effects of which continue into the APRP project period, and the impacts of the APRP that will continue beyond the project completion date.

Perhaps the best way of dealing with this last issue is to assume that any residual impact of the APRP will equal the residual impact of the prior APCP project when it was replaced by the APRP. This approach allows MVE to devote less attention to separating the effects of the APCP, a predecessor project to the APRP with the same goals, from the impact of the APRP itself. All

MVE would have to do is verify that the relative impact of the two projects ought to be roughly the same. The two residuals would then offset each other.

To ascertain the relative impact of the APRP and the APCP one could look at the time period over which reforms were made, the number of reforms implemented, or compare the broad conclusions of the impact of the APCP by Fletcher et al. (1995) with the broad conclusions of the impact of the APRP according to MVE. These are, admittedly, crude measures.

2. APPROACHES AND CONCEPTUAL MODELS FOR ASSESSING IMPACTS

To provide information for assessing the impact of APRP this plan focuses on four types of studies and analyses:

Targeted studies to provide descriptive and quantitative information regarding the situation prior to, during and following reform, and how the reforms can be expected to impact particular markets, sub-sectors or industries. Similar studies at the end of the project will document the extent to which the expected changes actually occurred, and identify other changes which appear to arise from the reforms.

Regression models for evaluating changes in factor productivity and allocative efficiency and for identifying relationships between variables that are related to each other in spatial, temporal or other ways. The same analysis can be performed both to identify key relationships, and show how those relationships change over time.

Egyptian Agricultural Sector Model (EASM) to identify allocations of resources that maximize the real value of agricultural production and welfare benefits across all agricultural markets. This technique allows analysts both to predict the benefits of a particular reform, and to evaluate the benefit from past reforms. The EASM already exists and is being updated by the RDI as part of its analytical agenda.

A Multi-market Model for analyzing changes in producer and consumer welfare in a broad, intra-sectoral context, and for separating the effects of the APRP from other influences. This model does not currently exist and would be developed by MVE.

These studies and modeling exercises will be aimed at the most important markets and activities affected by APRP reforms. They will build on studies and modeling exercises conducted by other APRP units and other projects in Egypt. They will form the backbone of the APRP analytical agenda.

The targeted studies will provide an understanding of the structure and performance of specific sub-sectors, trace causality, identify baseline measures of key impact variables in the subsector, provide technical coefficients for preparing analytical models, and provide estimates of potential impact required by the models for predicting, *ex ante*, the impact of specific reforms. The effect of the reforms on crops and sub-sectors that are not studied in detail will be picked up by adapting the agricultural sector model, and by developing a new multi-market model to handle the effects of the reforms. Other studies will provide an estimate of impacts policy makers wish to follow that are not picked up by the models

With respect to the subsector or market to which they pertain, targeted studies have a high probability of successfully identifying critical impact variables and how those variables change

over time. They are relatively straightforward to conduct and are readily understood by most analysts and policy makers. Their one drawback is that they are normally partial-equilibrium in nature; i.e. they cannot easily take into account the effect of changes in one subsector on another. Nonetheless, with proper qualification regarding the precision of measures of impact and the presence of spillover effects, they can contribute significantly to assessing the impact of the reforms.

To separate some of the impact of non-APRP reforms and events from APRP reforms, the plan also recommends using selected modeling techniques to supplement the targeted studies. The strength of the modeling techniques lies in their ability to look across sub-sectors and, to a limited extent, outside the agricultural sector for interacting factors, and to quantify those factors. The models complement the targeted studies by expanding the amount of information on impact which the data they collect can provide.

The targeted studies, therefore, serve a dual purpose: as partial impact assessment tools in their own right, and providing data required for obtaining meaningful results from the models. These MVE studies will also help develop an understanding of critical components of the systems being modeled, and will verify the quality of data to be used in building the models. Finally, some relationships are quite difficult to model and can be better analyzed via a more targeted study. Regulations and practices related to imports and exports, or government practices for allocating domestic output among competing uses are examples.

Building a meaningful model takes a great deal of time and good quality data. Moreover, the accuracy of the models is proven mostly in retrospect, after it may be too late to utilize alternative approaches. For this reason we see the more sophisticated modeling techniques (EASM, Multi-market model) as providing a higher risk, potentially higher payoff strategy. They are, thus, suitable as a component of a broader impact assessment strategy, but should not be relied upon as the primary source of information for assessing impact.

2.1 Tracing Impacts And Causal Chains

The key to successfully combining modeling techniques with more targeted and subsector studies to assess the impact of the reforms is in correctly tracing through the causal effects of the reforms, including negative as well as positive impacts. With many variables and policies relating to a given subsector changing at the same time, often in conflicting directions, specification of causal chains and impacts is, at best, difficult and imprecise. Markets are being constrained by conflicting and contradictory policies. These effects have to be summarized in one or two measures per subsector to be fed into the models. The models, in effect, abstract from the detail unveiled through the targeted studies. In so doing they gain the advantage of being able to examine a wider range of impacts at other levels.

In tracing the causal chain of effects of APRP policy interventions as they move through the agricultural economy, one discovers that the net impact differs in magnitude, depending on

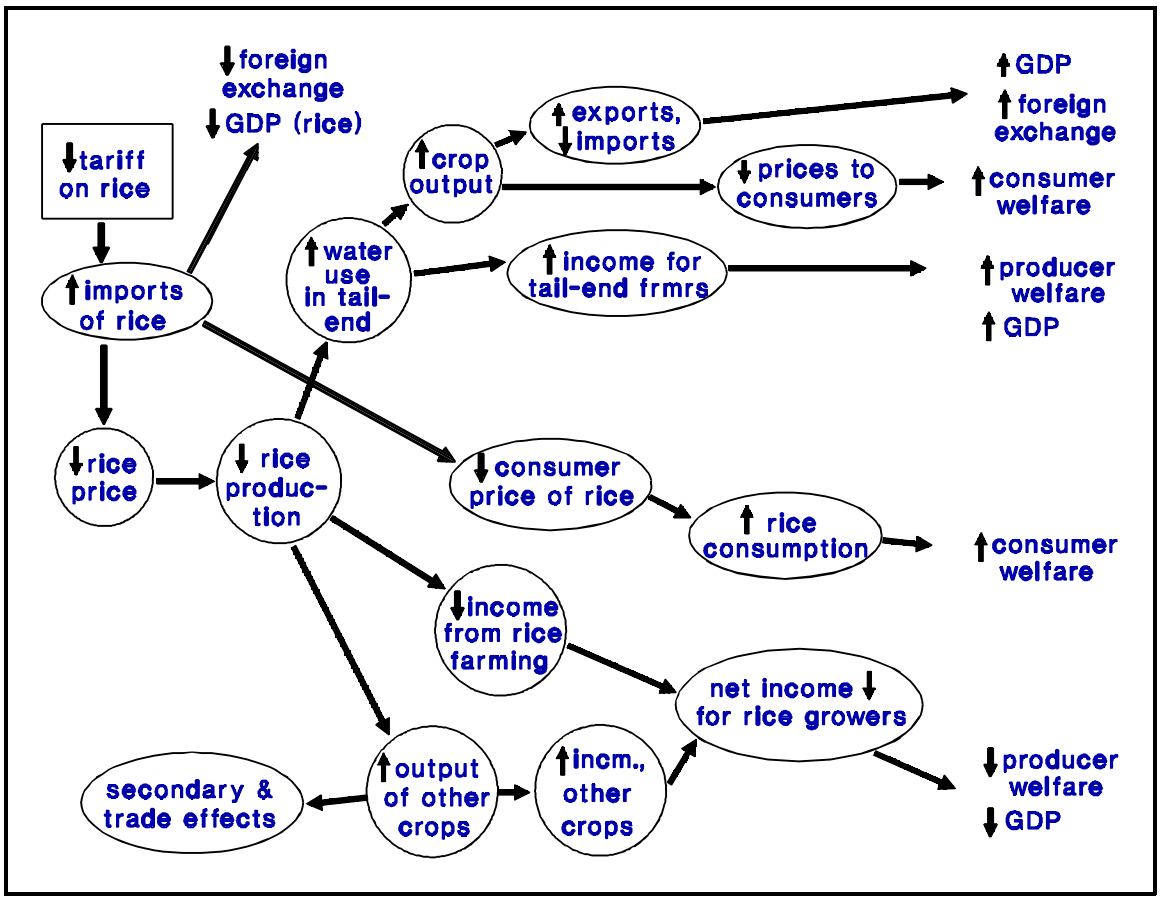
whether the exchange is within the national economy or between the national economy and the rest of the world. Within the economy each impact has counter-balancing impacts; but impacts from actions that involve foreign trade may have fewer counter-balancing impacts within the domestic economy.

The flow chart on the next page demonstrates this characteristic of impacts for an arbitrarily selected policy intervention: a reform designed to reduce tariffs on rice, assuming that farmers in the tail-end of irrigation systems have difficulty getting adequate water for their crops because of the heavy demands rice production places on the system. Subsequent impacts would be different depending on the source of the initial shock (in this case a reduction in tariff) and whether the water is used to produce export crops or not. The net impact in an aggregate sense is the result of all these choices and counter-balancing effects. In this example the net impact is probably positive since the gain in consumer surplus would probably exceed the loss in producer surplus, and domestic farm resources would be freed for a more productive use.

On the left side of the flow chart we have the reform. The center is the system through which the effects of the reform pass as they filter through the economy. This is what agricultural sector and multi-market models try to mimic. The right side describes the impacts that result from the reform, based on the assumptions that either implicitly or explicitly underlie the interactions built into the model. The impacts in the flow chart are mostly ultimate impacts, but one can certainly envision others that contribute to ultimate impact; increased exports, improved water efficiency and lower effective rates of protection are examples.

Reforms pertaining to prices, markets and trade will have an impact on producer incomes through prices paid and prices received by producers as a result of the impact of the reforms on import prices for inputs, on marketing margins and on export prices and quantities. They will also impact farmer incomes via crop selection, input quality, and availability of inputs and markets for output as the role of the growing private sector leads to increased competition in these markets. To the extent gains from these reforms are not captured by producers, they will pass to consumers in the form of lower prices, greater availability, lower public sector deficits and more favorable exchange rates for purchases of imports. The losers will be mostly those who benefit from inefficiencies in the current system.

Figure 1: Illustrative Causal Chain For Reduction in Tariff on Rice



Reforms pertaining to private investment and privatization in agribusiness offer the prospect of increasing productivity and reducing processing costs in the transformation of agricultural products, freeing up fixed capital and setting in motion forces that can favor greater competition and greater productivity over the long-term. This will eventually produce lower margins, improved quality, higher incomes for producers and/or lower prices for consumers with an increase in overall GDP and consumer welfare. There will be negative impacts too. Managers of existing public companies will lose their favored position and their ability to distribute patronage. Many workers will be thrown out of work in the short to medium term, and government social welfare costs will increase. This is an impact that is probably of greater concern to the GOE than to USAID

The group of reforms structured around improved land and water resource investments, utilization and sustainability will preserve resources and income for future generations. These reforms, if properly designed, will preserve land quality and encourage more efficient use of water today. They will help ensure that reclaimed land ends up in the hands of people who have an

economic interest in placing that land in production as quickly as possible. This, in turn, should have a positive impact on agricultural production, agricultural productivity, farm income, employment, consumer prices, availability of agricultural products in local markets, and on the public sector budget and taxes. Likely negative impacts from these reforms include lower incomes for existing producers because of reduced water allocation or increased user charges, loss of rents arising from non-transparent procedures for giving title to reclaimed lands, and loss of water and income by farmers benefiting from the pre-reform situation.

Reforms relating to agricultural sector support services offer to improve the flow of technology, credit and policies that benefit small farmers and their ability to organize. The reforms should enable farmers to gain control over more resources at lower cost, leading to increased incomes and a greater voice in their own economic destiny. There would be few effects on consumers in the short-run. However, a flow of new technologies adapted to the needs and resource situation of small farmers would probably increase agricultural productivity and reduce consumer prices in the long run. A likely offsetting effect would be reduced interest income for village money lenders as capital becomes more plentiful in rural areas.

Reforms directed at targeting food security and alleviating poverty will direct income generating opportunities toward lower-income households, while attempting to preserve their access to subsidized food items. If successful, these reforms will reduce the public sector deficit without reducing the welfare of lower-income households. It will shift a larger share of the tax burden to wealthier households more able to pay. Of course, this may well constitute a negative impact from their point of view.

This chart provides two lessons: 1) the complexity of the interactions from a national perspective makes it very difficult to trace through the impact of specific reforms; 2) to produce a suitable approximation of impacts, the analyst needs some sort of model of the relevant portion of the economy to convert causal chains into quantitative measures of Program impact. The models also force a discipline on the analysis that is difficult to maintain in subsector or other partial equilibrium studies.

2.2 Cautions Regarding the Use of Models for Assessing the Impacts of APRP

Models are by definition a simplified representation of reality. Models vary from the very simple to the very complex, but any model presently usable by economists is an abstraction from reality. Nevertheless, applied economics permits development of models that are reasonably accurate as predictors of future outcomes. The issue is not *whether* the impact assessment should use models in sorting through the effects of the reforms; it is virtually impossible to incorporate theoretical considerations without some sort of model. Even the simplest formulation of economic impacts will be underlain by some sort of theoretical structure. The simpler the formulation, the greater the number of implicit simplifying assumptions. The issue is really one of selecting the appropriate degree of detail and specificity to build into the model being used, and at what cost.

Before a model can produce correct results it needs to define a correct set of structural relationships, specify correct technical input-output coefficients from somewhere else; and have access to a reliable set of data with respect to input levels and output. These can come from both primary and secondary sources. Defining correct structural relationships for an economic model requires a good understanding of economic theory and a knowledge of how the system being modeled may be constrained by factors that violate theoretical assumptions. Doing this properly requires a good understanding of the political, social and legal context in which the model operates.

In their attempts to mimic reality most contemporary models have dozens if not hundreds of variables and equations; it is likely that errors of specification (structure) will occur. Numerous real world factors influence the productivity of the agricultural sector in a nation such as Egypt. The analyst, facing time and resource restraints, must abstract from or simplify these real world variations in order to make the model simple enough to use. For example, observed wide variations in physical factors, such as soil productivity, water quality or climate must be simplified into regional aggregates. The varying productivity of the numerous crop varieties or livestock breeds must usually be represented by averages reflecting one or two varieties. Rice production opportunities may be represented by averages of either *japonica or philippine* varieties, or cotton by short staple or long staple varieties, or by a synthetic enterprise that reflects the sum of the others. Nonlinear functions may be simplified to linear approximations. Economic considerations also vary across a nation. Commodity and input prices may vary due to such factors as distance to markets.

Construction of sophisticated models of agricultural systems requires exceptional skills and training in the relevant theory, in computer programming and in mathematical modeling. Even among those with doctorates in Agricultural Economics, those particular abilities are relatively limited. For example, an Agricultural Sector Model has been developed and continually enhanced for analyzing agricultural policy issues in Egypt. Even though the conceptual framework and solution algorithms for agricultural sector models were developed by 1973 (by Alan Manne and L. Goreaux and associates for Mexico), relatively few additional applications have been completed and made operational (Egypt being one of those). This situation is likely more because of the heavy resource and skill requirements, than because such a model would not be useful for other governments.

In addition to specification error, the parameters and data which are inputs to models are subject to observational and estimation errors. This is particularly true of secondary economic data and other social statistics. Oscar Morgenstern (1963) and the like-minded Andrew Kamarck (1983) emphasized the limitations of economic data taken from published economic statistics which may be collected for purposes other than what the user has in mind. Economic data not collected for the purpose at hand may define or classify variables differently than needed for an impact assessment study. Economic data are frequently collected by inadequately trained personnel. Government tax collection activity, often a source of economic data, may be subject to deliberate misrepresentation or evasion. Only infrequently does secondary information come with

a careful description of how and for what purpose it was collected. Nevertheless, secondary data are usually less expensive and may be the only source when time and resources are limited.

Primary data have their own set of problems. While researchers can exercise good control over data collection and the type of information collected, information describing the characteristics of a large population is typically taken from a small sample of the target population. When a sample is collected in an appropriate way, relying on the theory of probability, observations from the sample can be generalized to an entire population. As with secondary data, though, primary data from surveys are unavoidably subject to several types of error, including sampling error, measurement error and non-response error. The task of survey design and implementation is to minimize these errors. While the improved accuracy of survey data makes it preferable in many instances, designing and conducting surveys which minimize errors is expensive and time consuming. In less developed countries, such as Egypt, the obstacles encountered in assembling accurate data, whether it be primary or secondary are even more formidable. See, for example, Casley and Lury (1987) and Casley and Kumar (1988).

To ascertain how well the model's predictions match observed reality, analysts perform validation tests as the model approaches completion. Such tests give a valuable picture of how suitable a given model might be for evaluating APRP reforms. Unfortunately, the test of accuracy can only be done after the bulk of time and money required to develop the model is already spent.

For agricultural sector models a common test is the *percentage absolute deviation* (PAD), which is the average percent by which predicted values differ from observed values, ignoring the sign, for the time period the model is designed to replicate (Hazell and Norton, 1986). Hazell and Norton (1986, page 271-2) observe that PADs measured in agricultural sector models may range from 5 to 15 percent. They offer the following guidelines: "A PAD below 10% is good; a PAD of 5% is exceptional and a PAD of 15% or more indicates the model may need some improvement before it can be used." Note that if the average deviation is 10-15%, the individual deviations must range around that number.

The reported PAD for the Egypt Agricultural Sector Model, 1994 version--is about 12% for an annual simulation, according to Hazell, et al.(1994). Comparing this average deviation to the normal rates of change expected for particular policy reforms, it is evident that the models are more suitable for measuring impacts that are expected to be relatively large over the projection period - though not as large as one might expect. Recall that the analysis is based on a with and without comparison. If the same model is used to project both the with and without scenarios, then the model should fairly accurately represent the difference between the two, even though each scenario is off by an average of 12%, or whatever. Of course, this assumes that the errors in the model do not, in important measure, arise from data representing the particular relationship being assessed. For assessing the combined impact of multiple relationships, this assumption is probably a good one.

2.3 Conclusions on Conceptual and Empirical Issues

Because of the numerous and varied influences on the course of the Egyptian economy over the period of the APRP, and because overall economic growth, or the lack thereof, will continue to be affected by numerous other factors, a correct assessment of impact of the APRP policy initiatives will be a challenging task. This task is made even more difficult by the short time over which the policy initiatives are in effect. The targeted studies provide a relatively certain, though less comprehensive, source of information and data for the assessment. The models proposed as part of the impact assessment studies, though less certain with respect to ultimate usability, impose the formal framework and discipline needed to trace through the varied effects of policy changes in a complex and dynamic system. However, it is possible that inadequacies in the data and in the models will be such that measurement errors can exceed the changes the impact assessment effort is designed to measure. That would reduce confidence in conclusions drawn solely on the basis of the results of the models.

3. DETAILS ON ANALYTICAL TECHNIQUES AND MODELS

As discussed in Section 2, the impact assessment planning team recommends a combination of techniques for estimating the impact of APRP. Targeted studies will provide a perspective on how a particular area of concern might be addressed or might benefit from a particular reform, as well as how the subsector is structured and performing. Some of the studies will provide input-output coefficients, marketing margins, estimates of production costs and profits and comparisons with similar operations in other countries or elsewhere in Egypt. They will help trace through the most likely impacts and lead to a preliminary estimate of those impacts from a partial equilibrium perspective. Parts of some of these studies are already complete. The details of what remains to be done are described in later sections.

For studies of water use efficiency, allocative and productive efficiency of farmers, the temporal distribution of benefits between APCP and APRP, we recommend regression analysis of the appropriate cross sectional and time series data. Such studies are straightforward and, like the targeted studies, are easily understood by most analysts.

To complement the subsector, market structure and regression studies, we recommend MVE join with RDI and IFPRI in the development of agricultural sector and multi-market models for evaluating sector level production and consumption impacts. These techniques are more complicated to utilize and to scrutinize. They require more specialized technical skills and can be very demanding in terms of data and time.

This section briefly describes the regression analyses and the agricultural sector and multi-market models. Appendix A contains greater detail on the models, and other modeling techniques which we have considered.

3.1 Using Models For Assessing Impact

Predictive models (the EASM, multi-market model or single-equation regressions) can be used to establish a range for the *with* and *without* impacts of specific APRP reforms. This requires simulating four different scenarios for each model, two using the base year predictive model, and two using the model after it has been re-calibrated with revised structural parameters at the end of the simulation period. It also requires guesstimating the proportion of the change in the exogenous policy variables that is due to the reforms.

The model is first run using base year conditions and structural parameters (scenario A). Base year refers to the year or period before the reform in question is implemented. Conditions are specific values of the exogenous variables (input and output prices, subsidies and taxes, tariffs and quotas on internationally traded goods, remittances, off-farm income, exogenous government income, population, and factors fixed in the short-run, such as farm equipment, educational

attainment, etc.). Structural parameters are the numerical values relating exogenous *policy* variables (x and z) to endogenous *target* variables (y). For example, if the equation $y = a + bx + cz$ is part of a larger structural system of equations, then a, b and c are structural parameters. In this illustration, y may be production of rice, x may be the price of fertilizer, and z the price of rice.

Both the exogenous variables and structural parameters may change over time for reasons that are not related to the specific policy being evaluated. For example, suppose privatization resulting from APRP reduces the price of fertilizer (a direct impact). Farmers respond by using more fertilizer, with the amount of the response depending on the size of parameter b. Suppose also that GOE independently launches a new fertilizer-promoting extension program, or that plant breeders develop a more fertilizer-responsive rice variety. In this case it is more than likely that the parameter b also changes over time, for reasons not related to the privatization effort. Likewise, the introduction of a market information system under APRP may alter parameters b or c in the above equation. To separate out these effects, the model must be re-estimated, or in other words re-calibrated, at the end of the simulation period using post-reform structural parameters and values (scenario C). Then both models are run again using values for the parameters that were used to calibrate the other version (scenarios B and D). This approach provides an estimate of the with and without impacts of the APRP, as opposed to the before and after effects.

In most cases this approach will only provide a range for the with and without effects. Scenario A estimates base year parameters using the base year structural model and base year values. Scenario B uses the base year structural model, but values for the exogenous variables prevailing in the post-reform or end-of-project year. The difference between the two for the sum of producer and consumer surplus provides as estimate of impact on that impact variable, utilizing the base year structure. For example, compressed marketing margins or reduced import tariffs, reflecting a GOE decision, may lower prices of fertilizer and rice, inducing a change in the sum of producer and consumer surplus. For scenario C, the revised predictive model uses post-reform structural parameters with conditions prevailing at the end of the reform. In the fourth and last step, scenario D, the revised model is run using post-reform structural parameters but with conditions prevailing in the pre-reform period. The difference between C and D provides an estimate of impact based on the end-of-project structure of the model. The difference in the numerical results obtained for an impact variable between scenarios A and B on the one hand, and C and D on the other, provides a range within which the actual impact of the reform or reform program falls.

To the extent that changes in the exogenous variables can be attributed to APRP reforms, the difference between scenarios A and B and C and D will require less guesstimating for non-program impacts. In a similar vein, if the reforms or other factors cause little change in the structure of the markets and relationships being modeled between the pre-reform and post-reform periods, then the difference between A and B alone would suffice for an estimate. A judgement can be made near the end of the project as to whether changes in structure between the base

period and the end of the project are likely to be of sufficient magnitude to warrant recalibrating the model. If not, time will be saved for other tasks.

3.2 Regression Analysis

Regression analysis is a useful tool for describing the relationship between variables that are related to each other in some way. Regression analysis will allow MVE to separate the effects of APRP policy variables from uncontrollable variables on target variables. Moreover, regression analysis will reveal the *independent* effects of competing or complementary policy variables on target variables. A number of MVE studies are proposed that will use this tool.

3.2.1 Estimating Total Factor Productivity (TFP)

The primary reason productivity increases are so important to economic advancement is that they conserve resources. These savings can be in human, capital, and/or natural resources. Getting more output per unit of input is just another way of saying that costs per unit of output are lower. Lower marginal costs lead to increased supplies and lower prices. With lower prices consumers can purchase more goods and services with a given amount of income. Productivity increases have been the chief source of increased real per capita incomes in the economic development process.

Productivity increases reduce inflation and increase competitiveness. In fact, productivity growth in Egypt's agricultural sector is vitally important for the country's competitive position in world markets. Research on productivity provides a better understanding of the factors which influence it.

Multi-factor productivity (TFP) is defined as output per unit of the inputs used. If Y is a measure of total production and X is a measure of the total inputs used, then TFP= Y/X, and the rate of growth of TFP is the rate of growth of Y minus the rate of growth in X. More specifically:

Y= f (L, S, W, K, G, R F, C, D)

where:

- Y= Real value of agricultural output in Egypt (farm level)
- L = Total input of farm labor
- S = Total land used
- W = Total irrigation water consumed
- K= Real private capital expenditures, annualized (e.g. machinery, pumps, etc)
- G= Real government capital expenditures (e.g. land reclamation irrigation improvement, annualized and lagged)
- R = Real research and extension expenditures (lagged)
- F = Fertilizer

C = Pesticides
D = Binary (dummy) variable representing initiation of structural reform policy

The relationship expressed in this equation is called an aggregate production function. It hypothesizes that the total value of agricultural production depends on privately chosen levels of inputs plus GOE and donor investments in research, extension and land improvement. Such a function can be estimated with aggregate time series data for Egypt using standard econometric techniques. Most of these data are included in the USAID Agricultural Data Base.

If the quality of data permit, it would probably be better to do this study using cross-section data. That would eliminate the effect of shifts in structural relationships that underlie most time series data for the agricultural sector over the past ten years or so. Data collected by the FSR EIHS study or, hopefully, production, input and cost data gathered by MALR extension agents in each governorate, are likely sources. Determining which data source would be best will require that a consultant spend a month or so examining the USAID data base, production and input data from the FSR survey, and the results of the study of the nature and quality of MALR production data recommended in section 5.5. Ideally, the review of these data sources would be combined with responsibility for developing the model for estimating total factor productivity.

3.2.2 Testing for Allocative and Technical Efficiency

If the FSR (IFPRI) or MALR agricultural production data are determined to be adequate for the purpose of estimating farm level production or profit functions by crop, it will be possible as well to test for farm-level technical and allocative efficiency by type of farm (by size, region, use of extension services, crop specialization, etc.) using standard techniques (e.g., Gallacher, Goetz and Debertin, 1994). This includes using the estimated production or profit functions to calculate whether farmers are currently using resources optimally, that is, equating marginal returns to each resource in different activities, and equating marginal returns from each activity. In addition, frontier production function estimating methods are available to test whether farmers are operating at maximum efficiency levels in terms of physical output. Policy changes intended to encourage more efficient production can then be assessed by comparing the results of this analysis using with and without reform data, or before and after data but excluding the estimated impact of non-reform policies and variables.

3.3 The Egypt Agricultural Sector Model

The team recommends that MVE give serious consideration to using the *Egypt Agricultural Sector Model* (EASM) to analyze the impact of APRP on the agricultural sector. EASM is representative of a class of elaborate mathematical optimization models which calculates optimum production and consumption for the entire agricultural sector of a nation. The model finds allocations of resources which maximize consumer plus producer surpluses for all agricultural markets, subject to technical, institutional and resource (e.g. labor, land and water) constraints. It

can be adapted to the task of measuring impacts of APRP on target variables such as income, production, and producer and consumer surplus.

EASM 94, the most recent Egyptian version of agricultural sector models, is a descendent of a modeling procedure first developed for Mexico (by Alan Manne and L. Goreaux and associates), and applied later in Turkey, Central America and Egypt. (These various early models are discussed in Hazell and Norton, 1986). The most recent Egyptian version (hereafter referred to as EASM 94) presently operative was developed in 1994, using 1990 data, by Peter Hazell and several associates (Hazell et al.,1994). They used the model to evaluate effects of policy changes on Egyptian agriculture. Lofgren (1995) has also used the model for policy analysis in Egypt.

The RDI team plans to use EASM for *ex ante* impact assessment of proposed modifications in Egypt's agricultural policies. As a consequence, efforts to update EASM 94 to represent 1996 conditions began in late October, 1997, under the direction of Consultant Dr. Filmore Bender (Emeritus Professor, University of Maryland). With participation of experienced staff from both MALR and MPWWR, the updating is expected to be completed in early 1998. The revisions are mostly an update, but some added detail in the irrigation sector is being proposed by the portion of the updating team representing MPWWR.

3.3.1 Attributes and Capabilities of EASM

From the perspective of economic theory, the EASM model is very comprehensive. Commodity prices, consumption, production, imports and exports of all commodities are endogenous (variables to be solved within the system). Supply side considerations are derived from enterprise budgets reflecting inputs into, and output from, each agricultural production enterprise in the model. Demands are reflected as aggregate functions relating consumer price to output of individual crops, but such functions do not include cross price effects. Where appropriate, final demands for several crops (wheat flour, cotton, rice, etc) are expressed in processed form. Geographically, EASM includes representation of five Nile Valley regions (Upper and Middle Nile Valley and three Delta regions) and three New Lands regions.

Both crop and livestock sectors are represented in relative detail in EASM. It includes up to thirty-seven types of cropping activities, including all major crops; some important ones are represented in more detail. For example, it includes production enterprises for three types of cotton (long staple, medium long staple and extra long staple) and two types of rice (*japonica* or IRRI). Technology choices for each crop include three irrigation water application intensities (low, medium and high) and three planting dates (recommended, one month and two months later than recommended) with corresponding variation in yields and resource requirements. The EASM94 version incorporates five types of livestock production (cattle, sheep and goats, buffalo, broiler chickens and laying hens). The addition of livestock and alternative crop production technologies as endogenous components represents an increased level of detail from earlier versions of models of the Egyptian agriculture sector.

Agriculture sector models generally must be formulated for each use in order to provide a measure of the specific target variables appropriate for the problem at hand. Economic welfare (consumer plus producer surplus) is the main target variable used as an indicator of program impacts, but others could be used, according to the specific problem being addressed. These might include land and irrigation water use by region (including cropping patterns and crop production), livestock production, domestic prices for commodities, the quantity of imports and exports, employment and income. The model also provides shadow prices for water and land, by region. Most importantly, the supply elasticities it provides may be the only ones available for the multi-market model if the IFPRI production data proves inadequate for estimating supply elasticities as we fear and discuss in Section 5.

Data used as input to the EASM are generally based on other studies, particularly studies of costs and returns to agricultural producers. Such studies may have been done by the MALR, by donor agency employees or consultants, or any other source judged to be suitable and reliable. The USAID data base on production costs and returns in Egyptian agriculture, which is maintained under the direction of Dr. Mohamed Omran, could be a primary source for building and validating an updated model. Similarly, demand functions are taken mainly from previous econometric studies of Egyptian agriculture performed in government and academic institutions, or are guesstimated from studies done in other countries.

3.3.2 Use of EASM for Analyzing Impacts of Policy Interventions

EASM is designed to simulate response to a specific policy environment. Broadly speaking, policy interventions can be represented as changes in one or more of the three types of parameters found in mathematical programming models: prices (for inputs or outputs), changes in technical coefficients, or changes in resource quantity constraints. The net effect of each policy reform must be reduced to changes in one of these three parameters. For example, a public policy of investment in drainage of saline or waterlogged lands could be reflected by changes in availability of productive cropland and/or by changes in crop yields in the affected regions, depending on the impact expected or observed by analysts. Reductions in export duties or export taxes might be represented by adjustments in the demand curves for substitute products. Increased competition in the agribusiness sector leading to a reduction in processing and marketing margins would be reflected in lower prices for inputs or by shifts in the demand curves for competing products.

The EASM is best suited to study the impact of policies affecting specific production technologies (such as different cotton seed varieties) on producer and consumer surplus and resource allocation patterns, including the use of water. It can focus on Egypt as a whole or on different regions of the country. However, unlike the multi-market model, the EASM is not designed to evaluate trade-offs and substitutions on the consumption side, or the effects of income changes. In particular, the EASMis not designed to generate elasticities of demand. The EASM draws on price elasticities generated in other studies (such as the FSR surveys), and does not use income elasticities at all.

In contrast to the limited way in which it deals with demand, the EASM is well-suited for generating supply elasticities for use in the multi-market model. The procedure for doing this is straight forward. The (farm-gate) price of a commodity, such as rice, is increased by (say) 10%, holding all other prices constant. The EASM simulates how farmers change the production of rice as a result of the higher rice price, as well as the production of other (complementary and competing) crops, taking into account all relevant opportunity costs in production (i.e, relative factor scarcities). Using the original and the new production levels, the percent change in the quantity of each crop produced is calculated. These changes in prices and quantities are all that are required to calculate the own- and cross-price supply elasticities for rice. For example, the own-price elasticity of supply of rice is equal to the percent change in production of rice divided by the percent change in the price of rice (10%). The cross-price elasticity of supply between wheat and rice is equal to the percent change in production of wheat divided by the percent change in the price of rice. In a similar manner, supply elasticities are calculated for each of the other crops.

There are two compelling reasons for using the EASM to generate supply elasticities for the multi-market model. First, the EASM contains considerable detail in terms of different crops, including crop varieties, crop rotations and a seasonal disaggregation. This provides a greater level of realism than would be captured by virtually any econometric model created specifically to obtain supply elasticities. Second, with the EASM it is possible to easily obtain supply elasticities for different regions of Egypt. Given the apparent current availability of detailed official data at the regional level, it would be relatively expensive to replicate an equivalent level of regional detail using an econometric model.

3.3.3 Data Requirements for Using EASM for Impact Assessment

Before deciding definitively to proceed with updating the EASM for use in *evaluating* the impact of APRP, as opposed to projecting the impact, MVE should carefully review, in conjunction with the current RDI update of the model, just what data are likely to change as a result of the reforms, and what kind of effort would be required to get good end-of-project estimates for those variables for the model. This same issue presents itself with the multi-market model. Obviously, this task would be a lot easier if MVE were to have a project life that is one year longer than the other components of the project.

As a matter of principle it seems utterly reasonable that general USAID project design guidelines include a life-span for monitoring and evaluation units that is one year longer than other project implementation activities. Let us assume for the moment that the ongoing evolution of monitoring and evaluation philosophy within USAID can accommodate this kind of extension for monitoring and evaluation units in general, and MVE in particular. Then the remaining question is what data to collect toward the end of the last year of implementation that can be tabulated and analyzed in time to provide input for a model that, itself, needs to be re-calibrated and re-run using this most recent data - all before the last year is finished. This requires that we work back from the last day of the project.

We do not have the experience in Egypt necessary to estimate the amount of time it takes to collect and tabulate primary agricultural production data. This would be the most detailed and most complicated data that would need to be collected at the end of the project. With any luck, the project would not have (or is not expected to have) a significant impact on most agricultural production activities, and could focus its efforts on the important impact crops. In any case, it seems reasonable to assume that, by working through the MALR extension agents, and possibly the Acreage Authority, national level data could be collected at the end of the principal agricultural season and be cleaned, tabulated and published within four months of the end of the season. This assumes that the methodology for such a survey has been evaluated, tested and used for other MVE data collection needs in the meantime, so that all of the forms and tabulation programs are already prepared and tested in their own right. This would then leave about two months for re-calibrating (re-validating) and re-running the model in light of relationships that prevail between all of the variables at that time. If re-calibration is found to be unnecessary, so much the better.

In reviewing the calendar for the last year, let us not forget that MVE will be also collecting at this time end-of project data on private sector activity and employment in agro-industries, cost of production for agri-businesses, marketing margins for impacted commodities, and, if not done by IFPRI, food consumption patterns. It will have to recalculate production functions for estimating changes in allocative efficiency - hopefully limited to high impact crops, and will have to re-run the multi-market model to get changes in producer and consumer surpluses. Not a bad year's work, except it has to be done in six months so there is ample time for writing reports, holding seminars on the results, winding down project administration and for unanticipated delays. The implementation plan in Section 7 shows how we think this can all fit together. MVE needs to make sure our estimates for the time required to complete an activity in relation to the amount of data that will need to be collected is reasonable for each activity in the context of Egypt.

3.3.4 Conclusions Regarding Use of EASM for Evaluating APRP Impact

Models of the EASM type have the potential to be of considerable use to MVE for estimating efficiency and welfare impacts of APRP programs, though still in a static, partial equilibrium framework. EASM represents the state of the art in modeling a nation's agricultural production sector for the purpose of policy analysis. In addition to the estimates of changes in production, income and economic surplus, it will provide critical supply elasticities for the multi-market model. It would be wise for MVE to cooperate with RDI in their effort to update EASM 94, and identify what else needs to be done to adapt it for assessing APRP impacts listed in Section 1. If MVE decides that using the model is realistic in relation to the data that will need to be collected in the last year, then clearly RDI should take the lead in developing the model, with MVE providing specific input and requests for model runs related to impact assessment.

The estimates of producer and consumer surplus produced by the EASM have some limitations that it is important to appreciate. They do not include the effects of cross price elasticities and cross supply elasticities as policy impacts filter through the system. (The multi-

market model provides such estimates.) Moreover, it requires competent and skilled analysts to implement. Those with the requisite skills and training are few and in high demand. Furthermore, RDI or MVE will have to expend considerable time and budgetary resources to update the model for their own needs. If MVE can assure availability of skilled staff, adequate budgetary resources, and determines that it will have sufficient time to collect and tabulate the data it will need for the end-of-project runs, the impact assessment planning team believes that EASM, in conjunction with the multi-market model, can do a better job than targeted studies in sorting out the impact of APRP from everything else.

3.4 Developing a Multi-market Model

A multi-market model simulates equilibrium production and consumption (including exports) of major agricultural commodities in response to changes in income, shifts in demand, changes in prices or policy interventions. When a policy affects more than one agricultural commodity, but has negligible effects outside the agricultural sector, the use of a multi-market model is not only desirable but necessary for analyzing the impact of the policy across the subsector.

Because Egyptian households produce and consume a mixture of crops, rarely would a policy affect only a single commodity. Consequently, MVE would benefit from access to a multi-market model for assessing the full impact of any new policy or policy change. For example, a change in rice prices not only affects rice production and consumption, but also the production and consumption of other crops through substitution and income effects. A single-equation model for rice, or a rice subsector study, severely underestimates the full (agricultural sector-wide) impact of the initial rice price change. A multi-market model, on the other hand, traces out the full complement of production, consumption and income changes that occur across agricultural commodity markets.

In addition to collaborating with RDI on the EASM update, the team recommends that MVE develop a multi-market model for Egyptian agriculture in order to evaluate the impacts of various APRP benchmarks over time. Developing such a model is the only way in which MVE will be able to quickly but rigorously evaluate and compare alternative policy impacts which involve complex quantitative trade-offs within a consistent and comprehensive analytical frame-work that includes producers, consumers, input suppliers and GOE's budget.

A comprehensive multi-market model will allow MVE to trace through the complex effects, across all commodity and input markets, of changes in agricultural price and non-price factors, as well as other policy changes under APRP, on input use, output, prices of non-tradables, net exports of tradables, the balance of trade, real household income and income distribution, employment, consumption levels in different types of households and the GOE budget. When policies have opposite effects on the welfare of consumers and producers, or rice producers as opposed to wheat producers, the multi-market model will be able to identify the *net* effects on the welfare of all groups combined, in a dynamic framework. Subsector or single-commodity studies

will only capture effects within the subsector. While this is appropriate for some analyses, such an approach is clearly less acceptable whenever strong linkages exist between commodities and subsectors within the agricultural sector.

Unlike the EASM, the multi-market model fully integrates production and consumption decisions, and incorporates feedback from income changes on consumption and production patterns both within and across different crop subsectors. Using this model, it will be possible to evaluate both the direct and indirect (unintended positive and negative) consequences of policy changes for APRP target or impact variables. Relative to the EASM, the multi-market model includes considerable refinements in the specification of demand equations and income distributional consequences. For example, the model incorporates detailed income- and price-substitution effects across commodities, and can track changes in real income across producer and consumer groups stratified by income level, which the EASM is not set up to do. The multi-market model can also be constructed to capture employment changes that result from policy shocks, and trace through the repercussions on the GOE budget. It can be used to evaluate the effects of alternative arrangements for targeting food subsidies on the welfare of different income groups. However, compared with the EASM, the multi-market model will have less detail in terms of specific agricultural production activities and crop production regions. Multi-market models have been used in Egypt in the past to study the effects of a reduced wheat subsidy and currency devaluation on food security (Khattab et al., 1996; Sedeik et al., *c*.1997).

A multi-market model consists of a system of simultaneous equations representing input supply, input demand, output supply, final consumer demand, household income, balance of trade, and the GOE budget. The effects of policy shocks--such as a reduction in fertilizer or wheat prices due to marketing margin compression, a reduction in rice prices due to removal of tariffs, a reduction in the wheat subsidy, an improved market information system, or a relaxation of credit constraints--is traced through this system of equations to determine final impacts on output supply and demand, input supply and demand, agricultural and other income for producers and consumers by type of household (i.e., income distribution), the balance of trade and GOE net revenues. Obviously, it is necessary first to guesstimate how much of a particular shock, such as a price change, is due to the reforms versus unrelated factors.

A multi-market model can detail impacts by crop for variables listed above and for the commodities specified in the model, including cotton, maize, rice, wheat, *berseem*, beans, livestock (meat), etc. As discussed in Appendix A, when lagged variables are used in the econometric estimation of quantities supplied, the multi-market model can be used to forecast production (and consumption) into the future. Also, through sensitivity analyses multi-market models can reveal parameters which have particularly pronounced effects on income, income distribution and consumer or producer welfare. This provides a guide as to which elasticities and coefficients in the model need to be studied in greater depth to improve further the predictive abilities of the model.

Depending on the desired level of detail, data needs for such a model include a complete set of producer supply and consumer demand elasticities, input and output prices, incomes by type of household, nominal rates of protection, off-farm income and employment, as well as data on shifters in output supply, input demand and final demand. Shifters can include non-price variables such as access to credit, extension services or market information, educational attainment, and other fixed factors such as machinery, consumer tastes and preferences, off-farm employment, geographic location, etc. The elasticities used to develop the basic version of this model will be available from two sources: the RDI's EASM for producer supply elasticities, and the consumer demand elasticities generated by the FSR team, which are expected to be released in March 1998). Other data needed for this model are available from the FSR (IFPRI) surveys, and can be supplemented with official statistics from the Ministries of Trade and Supply and Agriculture and Land Reclamation. Additional details on this method are provided in Appendix A, which contains an example, and in Sadoulet and de Janvry (1995, Chapter 11).

A multi-market model is relatively simple and inexpensive to build. MVE can immediately initiate the construction of a simplified pilot model (drawing on the expertise of an experienced consultant, if needed) using supply and demand elasticities that have been reported in the literature for Egypt or for other countries in which production and consumption patterns are similar to those in Egypt. As updated supply, demand and income elasticities become available from RDI and FSR, they can be used to fine-tune and improve upon the pilot model for the end-of-project impact assessment.

The development cost of a multi-market model is reduced significantly because MVE will be able to take advantage of work underway in the RDI unit in collaboration with MALR, MPWWR and MTS on the EASM; the cost is small relative to the potential insights gained. The basic version of this model will allow MVE to assess the impacts of alternative policies on the production and consumption of each crop in Egypt, the real incomes of rural and urban households by income level, and the GOE's budget balance. Policies that can be evaluated with this basic model include changes in import tariffs on rice, changes in subsidies on wheat and fertilizer, changes in input and output prices that result from increased private sector activity (e.g., marketing margin compression), or other actions attributable to APRP. It appears that data and results from RDI's EASM and FSR surveys will be more than adequate to yield the baseline data or conditions and structural parameters (input demand, and output supply and demand elasticities) needed to develop a basic multi-market model.

With additional work, it will be possible to expand the multi-market model to include employment in different sub-sectors as target variables, and to model the effects of a public market information system or other non-price policies (such as a new, productivity-enhancing seed variety created in the private sector) on key target variables. This assumes, of course, that reasonable assumptions can be made regarding the impact of these policies on output in the first place.

Since the MVE Unit can experiment with, and fully evaluate the strengths and weaknesses of, the multi-market model at an early stage in the project, rather than having to wait one or two years for the model to be developed, this modeling activity in effect becomes a very low-risk but potentially high-payoff undertaking. This pilot model can serve as a basic conceptual framework for discussing policy impacts with policy makers and policy analysts in Egypt; it also can serve as an organizing framework for other MVE studies.

Depending on the desired level of detail, construction of a pilot multi-market model will require about four weeks of work. All of the data needed to develop the final version of the multi-market model either are already available or will be available in March 1998 (income and demand elasticities from FSR) and as the updated EASM is completed in the summer (for the supply elasticities). In the meantime, the multi-market model will also benefit from other MVE studies in terms of the institutional detail to be modeled and knowledge of how much of a particular policy change can be attributed to APRP. In return, the pilot multi-market model will help highlight which other MVE studies will have a high pay-off.

Regional differences in the impact of APRP can be simulated in the multi-market model using spatially-varying supply elasticities from the EASM. On the consumer side, the geographically-sensitive analysis on the supply side can be complemented with varying demand elasticities for rural and urban, wealthy and poor consumers, and for selected regions of Egypt using FSR results as they become available.

The multi-market model is also simple to operate once it has been constructed. Minimal training is required since the model is maintained and solved using only a spreadsheet. The model is transparent in the sense that parameters of the supply and demand equations appear explicitly in the spreadsheet and are easily changed to conduct policy simulations/experiments or sensitivity analyses. No new software (GAMS) is required for MVE to use this model. Of the three models reviewed here, this is the only model that MVE can easily maintain in-house and use on a daily basis, with minimal investment of resources. Also, unlike the other two models, the multi-market model represents less of a black box. It will be more readily understood by policy makers with minimal training in economics.

3.5 CGE Model

A CGE model should be used whenever a given policy change has an effect across more than one sector of the economy, and when it is important to analyze effects on aggregate macroeconomic variables such as national income and savings or GOE's budget deficit. For example, the overall effect of a devaluation of the Egyptian Pound on the national economy is best analyzed using a CGE, since devaluation would increase tourism and incomes from tourism, both of which would spillover into the agricultural sector. If, however, the goal of the analysis is to know only the direct effect of the devaluation on the agricultural sector, and there is no concern with indirect effects such as the impact of tourism on incomes and the demand for food in Egypt, then the multi-market model is perfectly adequate.

Most of the simulations that would interest MVE involve policies that are quite narrowly focussed on--and have effects only within--the agricultural sector. In this case a CGE model is simply unnecessary. A related important consideration is that, depending on the specific policy to be analyzed, a CGE model will not contain sufficient detail to yield useful and reliable results as they pertain to agriculture only. In this sense, Sadoulet and deJanvry (1995, p. 363) conclude that CGEs should not "...be employed for detailed predictions of the impacts of very specific policy packages, as they cannot properly model the peculiarities of any specific policy."

The primary advantage of a CGE over the other two models is that it incorporates the entire economy, and so allows for feedback effects between sectors. This is also a drawback, however, because the CGE is, of necessity, highly abstract and aggregated; key relationships (elasticities) in the model often have to be "guesstimated" due to data limitations and insufficient knowledge about functional relationships in the macro-economy.

Furthermore, the CGE does not lend well to a regional or geographic disaggregation. Although a literature is emerging on regional CGEs in the U.S., regional disaggregation using these models remains somewhat controversial, largely because of data limitations and assumptions that are required about regional trade relationships. The latter two concerns are especially important in the case of Egypt.

The CGE model is also less well suited to studying detailed nuances involving substitutions between crops, lags in crop production, and the use of common fixed factors across different crops (such as tractor power or educational attainment of the farmer), all of which can easily be incorporated into a multi-market model.

In conclusion, for most of the detailed and specific analyses we expect MVE to conduct over the next few years, the multi-market model is not only adequate, but indeed the preferred tool. A strong complementarity exists between this model and other MVE studies that are planned or already underway. This does not mean that MVE should rule out possible collaboration with FSR staff at some point in the future to merge the multi-market and CGE models. Recently, an attempt has been made in the literature to merge multi-market and CGE models, exploiting the advantages of each, and addressing some of the shortcomings of CGEs for modeling impacts of policies at the level of specific crops within the agricultural sector. So MVE would not be the first to try. Nevertheless, MVE modeling work at the frontier of the state of the art would probably have a high opportunity cost, so the team does not recommend extensive CGE model development and extension at this point.

Given USAID's significant investment in Strategic Objective 1 policy reform and related programs, the team recommends that USAID consider hiring a separate contractor to build a CGE model *across* sectors (and hence programs) that can capture key inter-sectoral relationships and assess economy-wide impacts of all of USAID's major policy reform programs. The World Bank may also be very interested in collaborating in this effort.

3.6 Summary and Recommendation

The Agricultural Sector Model for Egypt (EASM), multi-market and computable general equilibrium (CGE) models represent the state of the art of analytical techniques available for assessing various agricultural policy impacts in Egypt. Each model operates at a different level of abstraction, primarily because each is designed to answer a different set of questions, i.e. to simulate the effect of different policy options. Each model is more developed in those areas it is intended to analyze. Agricultural sector models focus on farm production decisions (crop and technology choices) and resource use, using simple demand relationships that do not shift and do not incorporate changes in income. Multi-market models, on the other hand, focus on production, marketing, processing and consumption in the food and fiber sector in a broader context, one that includes the effect of changes in household income and prices in response to changes in other prices, production technologies or policies. CGE models, in contrast, are economy-wide models which incorporate agriculture at a highly abstract level in order to focus on the effects of policy changes "between" sectors.

Each of the models reviewed here has specific strengths and weaknesses. However, the multi-market model is the best analytical tool for assessing many of the types of policy impacts which are of primary concern to MVE. The multi-market model will complement other MVE studies. Embarking on both activities simultaneously at an early stage in the project will improve the results of MVE's overall assessment effort. The multi-market model is relatively inexpensive to design, operate and maintain, and all of the raw data needed for the final version of this model either are already available or will be available at low marginal cost to MVE. The team recommends strongly that MVE use a multi-market model as part of its portfolio of tools for assessing the impact of APRP.

3.7 Other Quantitative Analyses

Numerous other analytical techniques can be used to document and/or measure various impacts of the project, including standard subsector studies using conventional economic theory, as well as studies of changes in trade protection and sub-national production shares over time.

3.7.1 Nominal Protection Coefficients

Market liberalization is an important component of the APRP, of interest to both GOE and USAID under SO1. The nominal or net protection coefficient is one way of measuring the extent to which goods move freely into and out of Egypt, that is, the extent to which markets are liberalized and international prices reflect domestic opportunity costs. Protection coefficients for key crops are readily calculated using data from Dr. Omran's dissertation. If the same data are collected at a later date, it will be possible to measure changes in protection coefficients over time. For the purposes of MVE, this coefficient has another important virtue. The total nominal protection coefficient for a specific crop can be decomposed into direct and indirect coefficients using relatively straightforward techniques. The direct coefficient captures the effect of trade

policies established specifically for the crop in question. The indirect component captures the effects of macroeconomic distortions--usually reflected in a distorted exchange rate--on the crop. It is not uncommon for these latter effects to not only offset the direct effects on a commodity, but to dominate them. By decomposing nominal protection coefficients in the pre- and post-reform periods, MVE will be able to evaluate the impact of agricultural policy reform as distinct from general macroeconomic reforms in one important area--that relating to liberalized markets--in a relatively simple and robust manner.

The nominal protection coefficient for product *I* is calculated as $NPC_i = p/p^b$,

where,

p = the domestic price of product *I*,

p^b = the border price of product *I* expressed in Egyptian pounds (LE), and

p^b = $ep^\$$, where

e = the exchange rate (in LE/$)

$p^\$$ = the international price of product *I* measured in U.S. dollars.

When NPC_i is greater than 1.0, Egyptian farmers are protected from international competition while consumers are taxed by paying more for product *I* than they would under a free trade regime. Conversely, when NPC_i is less than one, Egyptian consumers are subsidized while farmers are taxed. When the coefficient is equal to 1.0, markets are not being distorted by prices; neither farmers nor consumers are taxed or subsidized. The quantity (p/p^b)-1 is defined as the nominal *rate* of protection.

For the most part, data needed to calculate these coefficients historically are available from Dr. Omran's thesis. Data for calculating them in future years will come from then current domestic and import prices for the particular commodity. Care must be taken to define a homogeneous and specific variety or form of a commodity in order to ensure consistency in the coefficients over time, and to use weighted averages over the course of the year in computing annual prices. Getting prices for commodities which are not actually imported requires special care. Details about the decomposition of the protection coefficient are reported in Appendix A.

3.7.2 Shift-Share Analysis

Shift-share analysis is used to decompose the source of a region's economic or crop production growth into various components. This kind of sub-national analysis will allow MVE to monitor and assess some of the spatial or geographic impacts of agricultural policy reforms. The analysis is best suited to understanding why a particular region experiences growth in agricultural production; it is not suitable for a national-level impact assessment. The method is based on the share of a region, such as a Governorate, in national crop output growth. A region which is more competitive and efficient than other regions of Egypt will, over time, account for an increasing share of the total amount of agricultural output in the country.

Shift-share analysis attempts to identify the forces affecting growth or decline of farm production at the sub-national level. Such regional or Governorate-level changes can be attribu-

ted to three different sources: (1) change that is occurring at the national level; (2) concentration of farmers in producing crops that happen to be in faster- or slower-growing crop sectors; and (3) the fact that local farmers may be more or less competitive than the national average. In the latter case, they would bid economic activity away from other regions over time. Thus, shift-share analysis is used to determined whether the local region is shifting into faster or slowing growth crop sectors over time, and to identify the specific crop sectors in which the region's growth is occurring.

Shift-share analysis moves the analyst to examine why the differential rates of growth are occurring. Policy related variables that may explain some of the differences might include land and water policy, or research and extension directed at particular crops or regions. The base year for the calculations could be varied to account for differences in when the production of different crops was liberalized; to capture only effects of APRP, the base year should be 1996. The necessary calculations can be easily accomplished using a spreadsheet and are reported in Appendix A.

3.8 How Models and Studies Relate to Impact Measures

The previous sections have provided a list of the impacts selected for measurement and a review of the techniques for measuring these impacts. This section integrates this material and identifies which technique or techniques can be used for assessing the particular measures of impact. In Figure 2 an **X** in the cell indicates which technique will be used for the respective impact measure.

Statistical regression is capable of identifying the independent effects of explanatory variables on a dependent variable. Regression studies will fit an econometric model with either cross-section or time series data. Regression can be used to analyze the real value of agricultural production and the efficiency of resource allocation across all inputs, not just land or water. Regression techniques can also be applied to survey data, such as the IFPRI household survey to identify relationships between variables.

The *Egypt Agricultural Sector Model* (EASM) is a mathematical programming model which simulates equilibrium production and consumption from the entire agricultural sector. The model finds allocations of resources which maximize the real value of agricultural production and consumer plus producer surpluses across all agricultural markets, subject to constraints on resources (e.g. labor, land and water) and subject to technical and institutional constraints. EASM can also be used for estimating efficiency/productivity of resource use. EASM's income and welfare estimates, however, are based on comparative static analysis and do not represent the true effect of the reforms in a dynamic context. EASM will provide supply and cross-supply elasticities for the multi-market model. The model also disaggregates Egypt's agricultural production into eight regions, so it could, in principle, be used to assess regional impacts of APRP policies which have identifiable regional focus.

The *Multi-market Model* consists of a system of simultaneous equations representing input supply and demand, output supply, final consumer demand, household income, balance of trade, and government revenue related to the agricultural sector. Its role would be to analyze agricultural production, inter- and intra-sectoral income and welfare effects in the agricultural sector, and effects on GOE budget and on employment. It would provide the ultimate measure of impact from the most comprehensive perspective, short of a general equilibrium model.

The *Targeted Studies* will provide data for more certain, more easily understood and more conventional analyses of APRP effects, though admittedly from a partial equilibrium perspective. They will also provide detail necessary for utilizing or updating the modeling techniques, since both conventional and modeling approaches require the same data to evaluate impact. In addition, the targeted studies will fill gaps not elsewhere treated. The targeted studies will be based in part on surveys but as much as possible on various secondary data sources, and they will examine such topics as marketing margins, processing costs, employment, private sector participation, productivity of new lands and water user associations. For the subjects which they cover, they

Figure 2: Overview of Methods For Estimating Impacts

Method	*Impacts (changes in):* Agricultural Production	Effic./ Prod'y. (water, etc.)	Mkt'g. Margins	Employment	Income/ welfare and distribution	GOE budget balance	Private participation & dialogue
Regression	X	X					
Agricultural Sector Model	X	X			X		
Multimarket Model	X			X	X	X	
Computable Gen. Eq. Mod.	X			X	X	X	
Spec. Studies			X	X			X

will provide estimates of private participation, employment, marketing margins, production and efficiency.

4. PRIORITIES FOR TARGETED STUDIES

We recommend more detailed study of those subsectors and topics which we believe are most important for broad based growth and development in Egypt's agricultural sector today and in the near future. In general, these are the same areas where APRP is concentrating its efforts.

4.1 Cotton

Cotton is the most important cash crop for Egyptian farmers. According to Nassar et al. (1996) it had a relatively low DRC in 1992[1], is a major employer both in agricultural production and agribusiness, and has significant worldwide export potential. Cotton production is constrained by export controls, poor GOE pricing decisions affecting both public and private firms and participation, inefficient public sector ginning, spinning and weaving mills, and low quality textile manufacturing plants. The reforms promise to have a significant impact on farm production, employment and foreign exchange earnings from cotton related industries. Ongoing studies of the structure, conduct and performance of the cotton subsector represent a logical choice for special attention in the impact assessment plan.

Both RDI and the Cotton Sector Promotion Program (CSPP) financed by GTZ have an ongoing program of research for this subsector. These studies provide an excellent source of information on production costs, the present structure of the subsector, and the kind of impact to expect from the reforms. With proper coordination and sharing of objectives, these research programs can reduce the amount of work required of MVE. Appendix C contains a partial status report on the Cotton Subsector.

4.2 Farm Cropping Patterns, Input Use and Productivity

To obtain data for cropping activities included in the models, and to ascertain the extent to which input availability, credit, water and access to markets are restraining production, MVE will need to obtain good quality input/output data for Egypt's farmers. IFPRI has collected some of these, and other or similar data may be available from the governorate level agricultural services. In either case, MVE will have to collect the same data at the end of the project to document how production patterns and production levels have changed over the life of the project. This study is included in the Abt Technical Proposal and is central to the assessment of impact. It should be preceded by a study of the extent and quality of the MALR agricultural data collection system in order to identify the potential for using this source of data in lieu of conducting a separate survey, or at least reducing the scope of any such separate survey.

[1] DRC refers to Domestic Resource Cost. It is the ratio of the cost of producing a commodity, with domestic resources valued at shadow prices, to the net foreign exchange earned or saved by producing the commodity domestically. A ratio below 1.0 indicates the commodity is a net generator of foreign exchange earnings (savings); above 1.0 it is a net user. The ratio for cotton in 1992 was 0.6.

4.3 Fertilizer Imports and Distribution

Reforms begun under the second phase of APCP, and reinforced under the Government's own Economic Reform and Structural Adjustment Program (ERSAP), resulted in elimination of subsidies on fertilizer and limited the role of the Principal Bank for Development and Agriculture Credit (PBDAC) in supplying credit in kind. Fertilizer use dropped sharply following complete removal of the subsidies, but the proportion of fertilizer distributed through private channels increased sharply. In spite of relatively good market performance from private sector participants, disruptions in supply in 1995 led to significant backtracking on the goal of attaining free competition among all market participants. Recently there has been a move to restore the role of the private sector, at least partially, but much confusion remains regarding just what current policy is, in spite of what ministerial directives might say. Appendix C contains a partial status report on the fertilizer subsector.

With fertilizer, perhaps more so than with other commodities, the success of the reforms will be in the details of implementation. Attention must be give to the actual behavior and policies of PBDAC and the response of the private sector as well as to ministerial decrees. Given the importance of fertilizer to Egypt's agricultural production it is inconceivable that it not receive continued emphasis in policy reforms and in detailed studies to monitor those reforms and estimate their impact. The Abt Technical Proposal included an in-depth look at the fertilizer subsector. We have retained this priority.

4.4 Agribusiness

Agribusinesses will benefit in many ways from the reforms. For impact assessment we suggest focusing on the agribusiness aspects of wheat and rice, in addition to cotton and fertilizer. These four commodities share extensive linkages with the rest of the economy, and have already benefited from considerable study. In addition, since many of the reforms pertain to actions which are specific to individual subsectors, concentrating on them should capture the bulk of the impact of the reforms on agribusinesses. The availability of previous work on wheat and rice agribusinesses should mitigate the work burden they add for MVE over that planned in the Abt Technical Proposal.

4.5 Rural and Urban Household Income and Expenditure

Many of the obstacles to an efficient agricultural sector in Egypt arise from a deep concern by the government that the poorer segments of the population benefit fairly from the fruits of development. Redundant public sector employment and food subsidies are two ways the government has chosen to accomplish this. Success with policy reforms will require that these concerns be addressed in ways that the government finds credible. Targeted food subsidies appear to be an acceptable way to do this.

The Food Security Research (FSR) unit of APRP has conducted an integrated household income and expenditure survey (IHS) that is forming the basis for formulating policies to target food subsidies. In order to evaluate the impact of these measures ex-post, MVE will need confirmation that the reforms had the intended effect. A model can estimate changes in total consumer income, but will probably not be able to disaggregate those changes in sufficient detail to assess changes in food consumption patterns. Rather, it will be necessary to conduct another sample survey to measure how food production and food consumption patterns have changed. This will require another analysis of food expenditure data that is not in the current IFPRI workplan. Whether that follow-up survey is conducted by IFPRI or MVE, it needs to be done. Clearly, IFPRI has a comparative advantage in doing such a study.

4.6 Subsectors With Lower Priority

Wheat, rice, horticulture, maize and livestock should not have a priority claim on MVE resources for targeted studies. Much of the required data can be obtained by collaborating with other APRP divisions and USAID projects. Section 6 describes how this could be accomplished.

4.6.1 Wheat

Wheat covers the largest area, has one of the lowest DRC's of production among Egypt's major crops (Nassar et al., 1996), is the top food crop by production, is the centerpiece of Egypt's subsidized food program and provides substantial employment in commerce, milling and baking. It deserves special attention in studying the impact of the reform program. However, much of the production response from freeing up farm production decisions has already been accomplished through reforms induced by the Agricultural Production and Credit Project (APCP). The effect on wheat production and consumption of reforms relating to targeted food subsidies, rationalization of water use, and major changes in the cotton subsector will be picked up by the agricultural sector and multi-market models. Finally, there is already a substantial body of research completed and planned by IFPRI for the marketing and agribusiness parts of this subsector. RDI is also doing a subsector map for wheat. It makes sense for MVE to build on this by ensuring that impact assessment considerations are included in these studies as much as possible rather than by conducting separate studies. Appendix C contains a partial subsector status report on wheat.

4.6.2 Rice

Rice production has grown sharply in recent years as high tariffs have kept prices high both for producers and consumers. At the same time, the high water requirement for rice has given rise to concerns that increased rice production may not represent an efficient use of Egypt's agricultural production resources, in spite of its relatively low domestic resource cost for local production (Nassar, 1996). Rice has emerged as one of the three most important crops by area and value. It competes for land with cotton and maize and is the second most important food crop next to wheat.

A significant number of APRP reforms bear on the rice subsector, especially those relating to privatization and water resource efficiency. Again, enough research has already been done in the subsector to identify reform issues, which currently concentrate on reduced tariffs and increased privatization. MVE will need to monitor changes in rice processing and marketing as part of its ongoing study of agribusiness, but there appears to be enough data to provide a baseline for the structure, conduct and performance of the rice subsector (Wailes et al.,1995, Ragaa et al., 1996, and Ouedraogo and Ismail, 1997) and for rice consumption (IFPRI, CAPMAS).

4.6.3 Water Resource Use

Water resource use has always been an important issue in Egypt. The Aswan High Dam provided a respite from serious water shortage, but as more new lands are reclaimed and as upriver countries develop and divert more Nile waters, management of waters will become even more urgent. At the present time the focus is on improved water distribution within irrigation schemes, allocation of water to crops which yield the highest return to water, the productivity of water in the newly reclaimed areas, and, reusing drainage waters. Charging for irrigation water services and pricing policies for rice and competing crops will have a major impact on water resource development and use over time.

Investments in irrigation have a long lead time and can last for as long as 50 years. Thus inter-temporal water use issues are at least as important as spatial and quantity issues. These require more than a single period modeling exercise to resolve. Moreover, once Egypt develops a strategy it will need to pass legislation to implement the strategy. This suggests that measurable impacts from any such strategy will be a long time in coming and are, effectively, not amenable to assessment during the life of APRP.

Two areas where MVE can do something are evaluating the extent to which water user associations form and persist, and evaluating the productivity of investments in newly reclaimed lands. Preliminary work undertaken by others on both topics is either underway (GreenCOMIII KAP survey) or has already been completed (MALR et al., 1994). GreenCOM, for example, will ask questions of irrigation engineers and farmers regarding their knowledge of, attitude toward and experience with water users' associations. While GreenCOM's surveys will not evaluate the effectiveness of water users' associations, they have the potential to provide some useful evidence as to what has been the persistence of associations established under earlier programs. MVE could build on these efforts and obtain the data it needs for assessing the impact of each.

4.6.4 Horticulture, Maize and Livestock

Horticulture, maize and livestock do not appear to be as directly affected by the reforms as do these other subsectors. The private sector appears already to be of sufficient size to ensure effective competition for public sector entities operating in this sector. The agricultural sector model should pick up most of the impact of the reforms via price effects and changes in crop mix.

Horticultural export promotion, on the other hand, while an important program initiative by USAID, and a key intermediate result for SO1, does not seem to figure very prominently among APRP policy reform objectives or Phase I and Phase II benchmarks. Moreover, getting good data on production costs for horticultural crops will be expensive because of the wide variety of crops involved. Since the ATUT project is studying and monitoring this subsector, we recommend that MVE coordinate with them to get the data it needs for updating and expanding the agricultural sector model. Furthermore, RDI will complete a horticultural subsector map in the first half of 1998, which will provide information on the organization of the subsector, including the numbers of firms (and workers) at each stage of the subsystem, product flows (for the domestic and international markets), processed throughput, and other features of the subsystem.

5. DATA AVAILABILITY VERSUS REQUIREMENTS

This section contains a summary review of relevant surveys completed or planned by IFPRI, CAPMAS, MVE and CSPP related to the priority areas for targeted studies. It includes a summary of data collected, an evaluation of completeness for purposes of assessing impact, and suggestions for correcting deficiencies, where appropriate. Appendix B contains greater detail on some of the studies, and on the lower priority studies. Table 2 provides a summary of the nature of the data available from each survey.

Reviewing a study and data base from the perspective of its usefulness for a subsequent analysis is necessarily a cursory endeavor when done in the context of an undertaking such as was given to the impact assessment planning team. Not only is there very little time to spend on reviewing individual studies, but the real potential of completed and on-going studies often lies in what doesn't get tabulated, analyzed or published. Questionnaires may be structured so that they get all necessary information, but if it takes three hours to conduct the interview you can be sure that data toward the end of the questionnaire are less reliable than those at the beginning. In the case of the FSR EIHS, certain response options to questions, if widely used, will significantly reduce what can be gleaned from the production data. Only a look at the raw data in the form of preliminary frequency distributions will answer this question. Even if the responses themselves look ok, the analysis may uncover inconsistences and contradictions that make the data unusable. The fact that data are collected doesn't mean they are usable. Surveys always provide mean estimates. The critical question is what do the estimates mean.

What is really needed as soon as possible is for MVE to prepare more detailed subsector status reports and on more subsectors than those presented in Appendix C. Those status reports should review all available studies relating to both priority and lower priority focus areas, from a fairly narrow perspective:

What are the potential consequences from the reforms which they reveal;
Who is likely to bear those consequences;
What data do the studies contain that enable quantifying those consequences;
What measures can be used to quantify those impacts/consequences;
What baseline data are provided by the study that merit remeasuring at the EOP;
What is the likely impact of the reforms on those measures.

Fleshing out this information up front via a comprehensive review, by subsector or APRP policy group objective, will help focus attention on identifying usable, measurable and meaningful

Table 2: Summary of Sources of Information by Crop

Subsector	Prod. Costs & Technical Coefficients	Prices	Marketing Costs and Margins	Private vs. Public Sector Participation	Processing Costs and Tech. Coeffic.	Trade	Consumption and Utilization
Cotton	CSPP surveys in two governorates: Beni-Suef, Dakhalia. MALR	Seed - MALR survey Lint - ALCOTEXA	Partial calculation for 1996-97 (CSPP)	Ginning - HC & priv. cos. Export - ALCOTEXA Dom. Trade - residual once public co share known	Partial for 1996-97 (CSPP, RDI). See Krenz report of 6/97.	Exports: ALCOTEXA Imports: MALR, Phyto-sanitary Dept. & importers.	Domestic use in spinning - ALCOTEXA, MTS, textile holding companies
Fertilizer	Factories	Egyptian Assoc of Fertilizer Distributors	Costs from participants	Distribution - PBDAC, priv. share a residual	from factories (not a priority)	MTS, FAO other?	MALR
Wheat	IFPRI survey, May-June 1998 MALR	IFPRI survey, wholesale & retail, 6/97-5/98 CAPMAS	IFPRI trader and miller surveys for late 1996-Sept. 1997	IFPRI surveys of traders and millers; MTS for import	IFPRI surveys, especially for milling	MTS, FAO, donors, US Ag Attache, US Wheat Assoc.	IFPRI household survey, CAPMAS HH budget surveys
Rice	CSPP surveys, 2 governorates MALR	MALR surveys beginning ??? CAPMAS bulletins	from MALR surveys CAPMAS retail and producer prices	Trade - MTS Milling - holding company for public; private estimated as residual.	RDI - one representative public mill, 1997; Arkansas studies - 1993-94; 1995 data for 4 mill technology types	MTS, FAO	IFPRI household survey, CAPMAS HH budget surveys

indicators of impact for each priority focus. Once that is done, MVE will have only to identify what indicators are not supported by sufficient data, determine how to get those data, collect them as soon as possible, and then analyze them over the period between collecting baseline data and collecting end-of project data of the same type. In the last year of the project MVE would repeat those parts of the surveys or data collection activities that address these questions. The material to be covered at that time is likely to represent a small part of the subject matter covered in the original study.

5.1 The Egypt Integrated Household Survey (EIHS) - IFPRI

FSR's analysis of this survey, which is reviewed in detail in the Appendix, will provide consumption elasticities (own-price, cross-price and expenditures) for various food and non-food items, which can be used in the multi-market model. FSR is scheduled to release these elasticities by the end of March, 1998. As a minimum, consumption elasticities can be calculated both for rural and urban areas, and for high- and low-income households in each area. This will allow the demand component of the multi-market model to be disaggregated over space as well as by income group. Care needs to be taken in dealing with censoring problems or limited dependent variables in the data set (Goetz, 1995). Censoring occurs when a subset of households fails to consume or produce a particular commodity: the value for the variables in question is zero. In that case ordinary least squares estimation yields biased parameters, and different estimation methods need to be used.

Potential concerns about the demand elasticities estimated from this data set include the lack of representativeness regarding year-round consumption, the lack of longitudinal price variation for consumed items because the EIHS was a single visit survey that captured only spatial price variations, and the inclusion of a religious holiday in 1-3 days of one of the ten recall weeks, affecting 266 households or only about 10 percent of the sample. According to FSR, 1) the censoring problem on the consumption side will be taken into account, 2) CAPMAS data suggest a general lack of seasonal patterns in food consumption in Egypt, and 3) dummy variables will be used to control for any possible effects of the holiday on consumption patterns of the 266 households surveyed during the holiday period.

It appears that the consumption elasticities generated by FSR will be adequate for the purposes of constructing the multi-market model, and MVE will not have to generate its own estimates. However, a second round of the EIHS is highly recommended, as it would strengthen the elasticity estimates by using data during two different periods.

We won’t know for sure until the data are tabulated, but the agricultural production questions from this survey may not be able to produce supply elasticities for use in the multi-market model. To a large extent, success in estimating profit or production functions from the data will depend on whether there is sufficient variability in the cross-sectional price data (across the 125 communities), and whether adequate crop-specific detail is contained in the input use data for the previous year of production. The team has not been able to make this determination because the data have not yet been tabulated for these variables. Scrutiny of FSR survey instruments suggests the necessary data were collected, but may have been grouped together instead of separated by crop. This would make it very difficult to estimate supply elasticities for individual crops.

Determining whether or not the FSR data are adequate for estimating production or profit functions, and doing the actual estimations if they are, will require 2-3 weeks of work, depending on how the data are arranged when they are released by FSR. If the data turn out to not be adequate, MVE will have to use RDI's run of the EASM to generate the supply elasticities needed for the multi-market model. The disadvantage of this approach is that it will not then be possible to model the effects of changes in some of the shifters discussed earlier (access to credit, off-farm employment) using the multi-market model; the modeling component involving input supplies would be correspondingly limited.

FSR researchers will make the production data available to other users by February 1998, but they do not plan to analyze the data in the foreseeable future. This survey contains important baseline information for MVE's purposes, in addition to serving as a potential supplementary source of supply elasticities. For example, the male household survey instrument contains questions (page 42) about expenditures on fertilizer and use by crop, the source of the fertilizer, whether it was obtained on credit, the source of the credit (if any), whether the farmer obtained the desired amount of fertilizer and, if the answer to the previous question was negative, why the farmer was unable to get the desired amount. These survey data on purchased inputs such as fertilizer, insecticides, hired labor and seeds or young plants should be analyzed by MVE to construct a pre-reform baseline, which can then be compared with similar data at the end of the project. This task would add about two weeks to the 2-3 weeks required for estimating supply elasticities. Again, a second round of the EIHS would generate more accurate estimates of supply elasticities.

A potential problem for evaluating farmer efficiency using the FSR production data is that hired and own labor data are not available by crop; this will cause a problem for estimating production functions and profit functions, since it will not be possible to separate out payments to hired labor (to the extent that these payments are important) from returns to operator labor. Thus, it would be necessary to make assumptions about labor allocation by crop. As a minimum, however, it will be possible to estimate whole-farm production (value) functions from the data, which can be used to determine whether farmers are allocatively and technically efficient in terms of aggregate farm inputs and overall production, as opposed to the production of specific crops. These could be estimated both from the IFPRI data and from an end-of-project survey to document any change in allocative and technical efficiency over the life of the project. As in the case of the consumption data, care needs to be exercised when analyzing households that are not producing certain crops, which leads to the censoring problems discussed above.

5.2 CAPMAS Household Expenditure Survey (HIECS)

In contrast to the FSR EIHS, the 1995-96 CAPMAS Income, Expenditure and Consumption Survey visited each household ten times over the course of one month. The enumerator gave the household a diary at the first visit and told the respondent to record diligently all expenditures which the household makes for one month. In the course of the ten visits, enumerators verified expenditures since the last visit, recorded household demographic information, household income, and asked questions about infrequent expenditures. Half of the 30 households, covered by each enumerator, were enumerated in the first six months of

the survey and the remainder during the last six months.[1] Because these interviews were more spread out than the IFPRI survey, one would expect, other things being equal, that the CAPMAS data are better quality. The report on the survey confirms this. The CAPMAS data should also capture the seasonal dimension more effectively, as the data was collected over an entire year.

In contrast to verbal reports that the quality of data collection for the 1995/96 CAPMAS survey was not particularly good, statistical analysis of data quality showed the quality to be quite high. All of the data were verified (double keyed) and several cleaning routines flagged out-of-range and inconsistent responses for checking and correction. Data entry speed and errors were well within international standards. The coefficient of variation for sample estimates was less than 1.5% for total expenditures[2], and ranged between under 1% for food and beverages and slightly over 5% for transportation and communication at the national level. At the regional level the coefficients of variation were approximately double these levels.

The Final Analysis Report (CAPMAS, 1997) includes cross tabulations relating to income, poverty, employment, cost of living, housing, education and medical expenses. It also provides estimated expenditures by 13 expenditure groups by region, and for eight subsidized foodstuffs. It provides expenditure elasticities for these same categories, and compares them to the 1990/91 survey. The coefficients of variation for the 1995/96 estimates of elasticities vary between approximately 3% and 12% for urban areas and 5% and 95%[3] for rural areas for subsidized food products, and between 1.5% and 12% for all but one expenditure category at the national level.

The major issue with respect to the HIECS is the same as with all CAPMAS data: limited access. GOE law with respect to data access is "rigid and anachronistic" according to the author of the Final Analysis Report (Cardiff; 1997). Access is limited by law to employees of CAPMAS; all government authorities who wish to collect any statistics must first get the approval of CAPMAS. In addition, no one, public or private, may publish or otherwise reproduce or make available any statistical information other than those statistics collected and compiled by CAPMAS, except with the agreement of CAPMAS. Outsiders who need more detailed breakdowns or analysis than that published in official publications must make a formal request and wait a lengthy period while the request is processed. Frequently the request for data is not filled to the satisfaction of the potential user.

The difficulty of getting data from CAPMAS, coupled with the central role that readily available, good quality data plays to the effective functioning of a competitive market suggests that reforms relating to data collection and access should find their way into APRP reforms in

[1] In total, nearly 15,000 households participated in the HIECS.

[2] That is, the standard error of the estimated sample mean was less than 1.5% of the mean itself. This is a very good estimate from a statistical perspective.

[3] This means the standard error of the estimated mean nearly equaled the estimate itself. This would be an extremely poor and unreliable estimate.

the next tranche. In the meantime, the CAPMAS data have the variability needed to estimate own price and cross price elasticities; CAPMAS is willing to let MVE provide an Egyptian consultant to work on the primary data in order to derive these estimates. Whether this will be necessary depends on whether there is sufficient variability in FSR expenditure data to derive the necessary elasticities. At this time we believe there is, so it may not be necessary to use CAPMAS data. But they do, at least, provide a backup data source for estimating elasticities.

5.3 Cotton Subsector Studies

The Cotton Sector Promotion Program (CSPP), MALR, MVE and RDI have all been working in various areas of the cotton subsector. In late 1996 CSPP surveyed cotton growers and focused on marketing practices. The study collected data on area planted to cotton, cotton rotations, cotton sales and prices received, market outlets, and problems encountered in marketing cotton, among other things. It appears to have been sufficiently broad based to provide nationally representative data on these topics.

CSPP conducted a separate cost of production study at this same time. This survey covered only two governorates and was intended to provide data for evaluating CSPP interventions. The survey gathered highly detailed data on input use, including labor, for seven cropping enterprises. CSPP has undertaken another similar survey in the same two directorates and has offered to include selected questions of interest to MVE. It is also planning surveys relating to gender impacts and collection of cotton seed price data in cooperation with RDI.

Apart from the cotton seed price study, the CPSS data may be too limited in coverage to satisfy the needs of MVE for representative production data. It would be useful for MVE to look closely at MALR data on cotton for these same two governorates and determine their representativeness. This should be done in conjunction with more extensive subsector status reports recommended earlier and the study of MALR data quality proposed later.

RDI and the Central Administration for Agricultural Economics (CAAE) are undertaking a joint study of marketing rings in 11 of the main cotton producing governorates that will end in early 1998. The study will collect data on prices received by farmers, deficiency payments and quantities delivered to ginneries. This study appears to be sufficiently broad based to provide nationally representative data. The output will be useful in quantifying the margin between farmers' sale price and the into-gin price, a key indicator of how much the system is costing farmers.

MVE carried out a similar survey of producer/sellers and representatives of trading companies (buyers), PBDAC and CATGO at 50 marketing rings in eight governorates for its verification program. The study seems to be collecting much the same type of data as the RDI/CAAE survey.

RDI is conducting other studies of the cotton subsector, including a cotton subsector map, monthly cotton situation and outlook reports, a 1997-98 cotton marketing season assessment, development of a partial equilibrium model for evaluating the effects of cotton export pricing policy, and an analysis of the financial performance of public spinning and

weaving companies. It also intends to look at changes in the organization, ownership, management and performance of the textile industry as part of its analytical agenda. Taken together, these studies can provide a significant portion of the data MVE will need for establishing baseline measures for the variables it needs for measuring impact. However, to identify exactly which ones, it will need to complete a more complete subsector status report in which it defines these variables precisely.

5.4 Chemical Fertilizers

As part of its verification program MVE collected several types of data on fertilizer. This information appears in a separate MVE Verification Report. Data collected include the following:

- ex-factory prices paid by PBDAC for five fertilizer types, 1991-92 to 1996-97
- monthly world spot market prices of nitrogen fertilizers, July 1993-April 1997
- PBDAC retail fertilizer prices in Lower Egypt
- maximum farm prices allowed for imported fertilizers
- factory by factory production of fertilizers for two periods: July-December 1996 and the first quarter of 1997
- fertilizer imports by type under the customs duty exemption (August 1995 to mid-April 1997)
- private sector fertilizer stocks and GOE regulated sales prices

Data on fertilizer production and distribution, quantities and prices to either public or private dealers, whether wholesalers or retailers, are available on a monthly basis at the producing factories. Information on the number of fertilizer wholesalers, their sales volume, and retail prices is available with the Egyptian Association of Fertilizer Distributors. This data can be used for making estimates of private sector participation in fertilizer marketing and agribusiness.

Data on individual farmers' use of fertilizers for the different crops is available in detail from farm level extension agents. MALR estimates crop production costs using fixed technical coefficients for each type of fertilizer by crop, which are then multiplied by the current fertilizer price to arrive at the fertilizer input cost. The technical coefficients tend to remain fixed from one census to another. This suggests that MALR data on fertilizer use and response will probably not be useful unless MVE launches its own study of farm cropping patterns, input use and productivity, probably in conjunction with traditional MALR data collection activities at the farm level.

MVE may have to collect and update data on fertilizer marketing margins and distribution shares (public vs. private) as part of its ongoing monitoring and impact assessment. However, data on costs of operation for the different units in the marketing chain are not available for either wholesalers or retailers. Such information is necessary for the estimation of the performance of the various agents working in the marketing system for fertilizers. When required, a sample of each of these groups could be interviewed to serve the purpose.

RDI completed a study of fertilizer supply, distribution, and trade, using Magdy el Guindi as a consultant. It examines supply and demand for different types of fertilizer in the domestic market. Data have been gathered on import and export volumes and prices. Domestic supply and utilization are forecast for future years. RDI follow-up to this study is not yet known.

5.5 Farm Cropping Patterns, Input Use and Productivity

MVE needs data on cropping patterns in order to update the models and test the impact of the reforms on farm productivity and allocative efficiency. Ideally the FSR farm production data would be adequate for this purpose. But even if it is, MVE still needs to collect similar data at the end of the project. This is not in FSR's current work plan.

The MALR is the other principal source of farm production data. It has its own set of problems. Apart from the four principal crops of rice, cotton, wheat and maize, coverage appears much less intense. Moreover, it appears that farm production costs are derived by applying fixed coefficients to measured area.

To confront this problem squarely, MVE needs to conduct a study of MALR data collection, tabulation and reporting procedures for a representative number of governorates. It appears that area data are quite good, and that farmer contact between agents is also quite good. There also appears to be a very good recording system in place for collecting data on the four principal crops.
The question to be answered is how easily can this system be extended to other key crops for the one or two years of importance to the impact assessment. The MALR agricultural data collection system is discussed in Appendix B.

One thing is clear. It will be difficult to have much confidence in data from cost of production surveys that provide limited coverage on the national level, unless there is relatively little variation across space. With an agriculture highly dependent on irrigation, there is probably less variation in inputs and outputs than elsewhere in Africa and the Middle East; but it is still hard to believe that studies with a narrow geographical focus will prove adequate for the impact assessment. Either FSR production data will be adequate - the team is split on the likelihood of that - or MVE will have to work closely with the MALR data collection system. A study of the quality of that system should have high priority.

5.6 Dr. Omran's/USAID Data Base

This data base can be used to decompose the effects of agricultural as opposed to general macroeconomic policy changes on net nominal protection coefficients, as discussed elsewhere in this document, for four strategic crops: wheat, cotton, maize and rice. Data needs include actual exchange rates, shadow exchange rates, domestic farm gate prices and international prices converted to farm gate prices. The data base will have to be updated as new data become available so that changes under APRP can continue to be monitored.

Given that time series regional (Governorate-level) data are available, it will be possible to carry out a shift-share analysis of production responses to the APCP and the APRP

(removal of production restrictions). Data needs include value of production of different crops in different regions over time, and are available from MTS/MALR, though with about a one year lag.

6. PROPOSED SURVEYS AND HARMONIZATION

In order to improve the likelihood that new studies collect the kind of information required for impact assessment purposes, we suggest that all APRP studies provide the following information, in addition to that needed for other objectives of the study:

- Assess the quality of the data collected for the purpose at hand.
- Estimate average or synthetic input-output coefficients for activity before the reform.
- Identify the causal chain and the nature of benefits that will accrue with reform.
- Identify any obvious positive or negative impact on other activities or subsectors from proposed reform.
- Estimate input-output coefficients for activity after the reform.
- Identify promising benchmarks and indicators for monitoring progress.
- Describe how one might measure the impact of the reform.
- Estimate the magnitude of each benefit that is expected if the reform is implemented.

For follow-up studies:

- Assess the quality of the data for the purpose at hand.
- Confirm the nature of benefits and costs as compared to those anticipated.
- Estimate the magnitude of the actual benefits and effects that arose from policy change.

To successfully harmonize data collection within the APRP and minimize duplication, each unit will have to be sensitive to the data needs of the other. Fortunately, such sensitivity seems adequate at the present time. Still, there are particularities of each unit's data needs that need to be respected if such cooperation is to continue. The basic distinction is that the output of FSR and RDI change the impact of the reforms themselves. FSR and RDI need data to measure the ex-ante impact of the reforms they are recommending while MVE needs the data primarily for ex-post impact assessment. Logically, it should be fairly easy to conceive of models and analytical approaches that can meet both needs. The advantage for MVE is that they will get tested and validated by RDI or FSR before MVE needs to use them for impact assessment. We would expect this to lead to a well executed impact assessment.

6.1 MVE Studies

This section summarizes the studies and modeling exercises we recommend for assessing impact. Most of these have been mentioned previously in the report.

6.1.1 Subsector Status Reports

The large number of studies already underway means that most APRP staff now have considerable experience with the agricultural sector in Egypt. Many of these studies are gathering pieces of data that MVE will need for assessing impact, but much of it does not have the coverage or specificity to be sure it will provide the data needed. The highest priority need is to look at how it all fits together, by priority subsector, and identify what specific indicators or variables MVE will use to measure impact - not classes of variables but specific variables, i.e. which margins, between which varieties, products or intermediaries, in which markets, at

which time of the year, for which purpose. Each of these studies will take three to four weeks per subsector, and will require the person conducting the study to get into details of what is known about the structure, conduct and performance of the subsector, available secondary data sources, what kind of data files are available from studies, and how suitable they are for providing data for the measures of impact that APRP staff agree to use. Each study should propose the specific variables that will serve as measures of impact, how they will be applied to products or relationships in the subsector that will not be measured, how they will be interpreted for impact assessment purposes, and most importantly, how they will be estimated, both for baseline and end-of-project values. Unless MVE confronts this degree of specificity now, there is a good chance of not having adequate data at the end of the project for assessing impact.

At a minimum MVE should conduct a subsector status report, in much more detail than those done by the team and presented in Appendix C, for all priority subsectors. This would include cotton, rice, wheat, and fertilizer. Similar specifications of variables to use for measuring impact should be done for food security, agricultural production and input distribution. In the minds of many it would also include water quality, though we don't see the project having a measurable impact on water quality over the three to four year period of the project. Deciding which variables to focus on for measurement should be done in close collaboration with the researchers who carried out the studies being reviewed to prepare the status reports. Obviously, deciding on variables to measure should concern the entire APRP staff, not just MVE.

The priorities we suggest for targeted studies assume that the subsector status reports are conducted first. That is the only way to avoid duplication, and is the best way, in our opinion, to identify effective measures of impact. Only when the subsector status reports are complete will it be possible to identify the specific additional studies that MVE needs to carry out, or the specific ways in which studies currently planned or underway might be modified to produce the needed measures.

6.1.2 Allocative and Technical Efficiency, Supply Elasticities

The IFPRI expenditure survey gathered data on production and inputs other than labor, though the data do include wage rates. It is not clear the extent to which enumerators succeeded in allocating purchased inputs to specific crops as they were instructed to do. As discussed earlier, however, it will still be possible to estimate whole-farm production functions to assess whether farmers are technically and allocatively efficient in their overall farming operation.

The estimated STTA for this activity is three person-months, once the 1997 IFPRI agricultural production data have been cleaned and determined to be adequate for the purposes of this study. If they are, another two person-months will be required by the year 2000 to repeat the analysis. As discussed elsewhere, IFPRI is unlikely to collect such data unless also given the additional resources needed to analyze the data.

6.2 IFPRI Surveys

The IFPRI agricultural production data contain information on access to sources of various agricultural inputs, these data should be analyzed with the goal of creating an initial baseline for the reforms. Farm households will have to be re-surveyed in a later (post-reform) year to determine whether and how their use of inputs has been affected by APRP. Topics covered should include production practices, crop mixes grown, input use, allocative and technical efficiency, and to what extent farmers are affected by market failure or credit rationing, if at all. Depending on details discussed elsewhere in this document (sample size, whether both consumption and production are covered, etc.), we estimate the cost of such an activity at around $100,000, not counting survey instrument design, MVE staff supervision and management, and data analysis. Ideally the survey would be conducted at the same time of the year as the first survey, and in conjunction with a new household budget survey similar to the first one, so that seasonal biases in both surveys are the same. Costs would be reduced if the follow-up survey used basically the same questionnaires as the first survey.

Part of the new survey will include reasons for changes in farmer behavior that have led to changes (if any) in allocative and technical efficiency, so that attributions to APRP can be made. The questionnaire should also explore issues related to input prices, access, quality, timeliness, general availability and credit in the year 2000 as compared with 1997, with a particular emphasis on fertilizer. In addition, rapid reconnaissance surveys need to be conducted in different regions of Egypt by 1999-2000 to determine whether the input distribution system is operating effectively and efficiently for other purchased inputs, including seed and chemicals. The information gathered from formal and informal surveys can be used to examine questions of distribution in addition to efficiency, such as how the ownership of factors of production is changing as APRP reaches its full impact (for example, using Gini coefficients or measures such as the Theil inequality index). It will also be essential to identify and sort out the effect of land reform initiated in October 1997.

An additional survey will have to be conducted in year 3 or 4 to assess whether and how agricultural reforms have affected farm-level productivity, efficiency and decision-making in general. We propose that 2,500 households be surveyed in year 3 or 4, with half drawn randomly from the original IFPRI-EIHS sample of households, and another 1,250 households drawn randomly which have not been surveyed earlier. This is the same sample size as was drawn for the first survey and should, therefore, produce sample estimates that are equal in precision to the baseline estimates. By allocating half the sample to the same sampling units drawn in the first survey, the sample will provide two independent estimates for each parameter: a ratio estimate for those units included in the first survey, and a combined sample estimate similar in precision to the first survey. The ratio estimate will provide a check on sampling error in the rest of the sample. Assuming both samples are drawn from the same population, with sample parameters therefore having equal variances, a 50-50 split provides the most efficient estimates for each of the two sub-samples. Other things being equal, more efficient estimates reduce the confidence interval required to produce a given level of confidence in the accuracy of sample estimates.

6.3 The Egyptian Agricultural Sector Model

The RDI team plans to use EASM for evaluating proposed modifications in Egypt's agricultural policies. At the present time the EASM is being updated and extended under the

direction of Dr. Filmore Bender of the University of Maryland. The EPIQ team economist, Dr. Dennis Wichels, has expressed an interest in employing the model for analyzing irrigation policy issues. It would make good sense if all of the APRP units could agree on the combination of modifications required in the models for their respective needs and establish a common strategy. They could share the burden of supervising development of the model and probably reduce costs.

6.4 The Multi-market Model

Drs. Ibrahim Siddik and Edgar Ariza-Nino of the Reform Design and Implementation (RDI) Unit have considered developing a Multi-market model at some point in the future to assist in their reform design work. Even though they have no time to work on the model, they could provide valuable perspective to MVE researchers and consultants managing and refining this modeling activity within APRP. This would complement their management of the agricultural sector model, which will also be housed in RDI. Dr. Ariza-Nino has experience working with multi-market models in Mexico and Ghana. Dr. Siddik also suggested that the multi-market model should eventually be transferred to the office of the Under Secretary of Agricultural Economics (in the same building as APRP), where it could be used to help analyze alternative policy scenarios. MVE should initially develop this model using an estimated one-month of short-term technical assistance (STTA). This estimate assumes that supply and demand elasticities are generated by IFPRI and the RDI team working on the agricultural sector model, as discussed earlier in this document.

The Information Decision Support Center (IDSC), which serves the Prime Minister and his Cabinet, is a potentially valuable collaborator for MVE. Individuals in the Center are knowledgeable about the EASM, have developed multi-market and CGE models, and have GIS capabilities. Moreover, the Center has access to important data sources in Egypt, and can provide research results directly to the Prime Minister and Cabinet. To our knowledge, Center members are not presently planning to use these models in a manner that would be useful to MVE, however. Also, while individuals in the Center clearly have the requisite technical skills to run sophisticated models, MVE would have to work closely with them to ensure that the models are developed according to MVE specifications. The present multi-market and CGE models, for example, do not contain sufficient crop or institutional detail to be useful to MVE.

6.5 The CGE Model

Constructing a CGE model is expensive. However, there is again a history of using CGEs in Egypt, and the marginal cost of custom-tailoring a model for MVE purposes would most likely not be excessive. A member of the FSR-IFPRI team, Dr. Hans Lofgren (IFPRI), is already using a CGE model of the Egyptian economy to study the effects of changes in the wheat subsidy program. The CGE Model is the only analytical tool which has the potential to allow MVE to rigorously attribute *cross-sector* impacts on all policy target variables (production, consumption, income, income distribution, employment, GOE revenues) to specific economic reforms being implemented in Egypt. More specifically, this model could be used as a foundation for examining the impacts of APRP reforms as opposed to the other macroeconomic policies currently underway in Egypt (and reviewed in Appendix A.2). However, modifications to the CGE model are required so that these policy changes can be

explicitly simulated in the model. Again, if MVE decides to use the CGE model for its assessment of impacts, coordination with FSR makes good sense. Given existing demands on MVE's time, a CGE model is not a priority at the present time, however.

6.6 Understanding Attitudes Toward Water Use with GreenCOMIII

GreenCOM-III is planning to conduct a Knowledge, Attitudes and Practices survey of 2000 farmers nationwide focusing on water use issues within irrigation systems. The study will include a look at the respondents' knowledge of water user associations. Also, the sample will be stratified according to location on the water distribution system, with half allocated to farmers in head-ends of distributor canals and half to farmers in tail-end areas. GreenCOM plans to repeat this survey prior to the close of the project in order to evaluate changes in knowledge, attitudes and practices.

This study represents a potential jumping-off point for MVE to undertake an evaluation activity relating to proliferation, persistence and effectiveness of water users' associations. The information on attitudes towards water supply between head-enders and tail-enders will be useful in understanding the status of water distribution to farmers, and provide hypotheses on how water use efficiency improvements might improve productivity. The structure of the survey methodology follows a well established format used for similar types of studies elsewhere. By collaborating with GreenCOM on this study MVE can get access to primary data with minimal effort on its part. The fact that GreenCom is also planning to do a follow-up study only adds to the appeal of involving MVE in the study from the start.

6.7 Harmonizing Data Gathering Among APRP Units

MVE will continue to work closely with RDI, FSR, and CSPP in gathering essential data for ongoing monitoring and impact assessment. MVE enjoys an excellent working relationship with all three units and informal lines of communication have been well established. MVE has collaborated with RDI in designing a data collection instrument for use in gathering seed cotton market information. MVE also is monitoring and providing input into the update of EASM, which is being led by RDI. RDI has provided consultants to assist MVE in developing a data base that will include secondary time-series data (domestic commodity prices, trade volume and value, agricultural production), interview notes and selected primary data sets.

MVE has provided input into the design of the FSR’s EIHS and the wheat milling survey, and it will advise IFPRI on the design of the wheat producer’s survey slated for May-June, 1998. MVE advised CSPP on questionnaire design for structured informal surveys of trading, ginning, spinning and weaving companies in early 1997 and will work closely with CSPP in designing a second cost of production survey in late 1997. MVE has also discussed the need to assess the quality and completeness of MTS price data (producer and consumer) for key agricultural commodities, and international trade in those commodities through the DEPRA.

MVE intends to stay alert to opportunities to collaborate with these other units. Coordination and harmonization will not automatically take place, as busy professionals tend

to their own business, especially under pressure. Nevertheless, the other units are receptive to working collaboratively, and have a demonstrated history of doing so.

7. PROPOSED IMPLEMENTATION PLAN

The proposed implementation plan describes baseline measures that appear to the impact assessment team to quantify the essential impacts of the reform regarding the subsector or activity. It lists both the baseline studies and the follow-up studies that are needed to complete the impact assessment, and it presents a calendar for executing the data collection and analysis activities.

7.1 Baselines For Monitoring The Impact Of Reforms On Priority Subsectors

In this section we discuss measures that can be used to assess impact, but reiterate that the final measures should be agreed upon only after the subsector status reviews are completed, and in full collaboration with the unit that collected the data or conducted the original study. Where the detail exists, most of these measures could be disaggregated by region to show regional impacts.

7.1.1 Baseline for Fertilizer

The fertilizer subsector has felt the impact of two shocks during the 1990s. First, fertilizer subsidies were gradually cut beginning in 1988, then cut virtually to zero in 1991-92. This caused a temporary decline in consumption. By 1992-93 fertilizer consumption regained its earlier level of consumption. Fertilizer distribution was liberalized beginning in 1990-91, as private firms and cooperatives were allowed to purchase fertilizer from domestic factories at fixed prices and sell at market prices. By 1994-95 the share of the former monopoly distributor of fertilizer, PBDAC, had declined significantly as the private sector and cooperatives increased their market share greatly in a competitive market.

This progress in liberalizing distribution was reversed in 1995-96, when the GOE directed domestic factories to supply all fertilizer once again to PBDAC, put a ban on exports, and allowed 1.5 million tons of fertilizer to be imported by private firms with duty exemption to compensate for a partly real and partly perceived domestic fertilizer shortage brought on by high levels of exports in 1995 by domestic producers. By mid-1997 the perceived crisis had eased and private traders and cooperatives were again beginning to play an important role in distribution. It will likely take several years to return to the vibrant distribution system of 1993-95. Thus, no one year is suitable for a base period.

Some of the necessary data are available from earlier studies, but there are gaps that need to be filled. A fertilizer subsector database should be compiled going back to the early 1990's, if not earlier. Such a database should include the following:

- estimated fertilizer use by N, P and K, from 1985 to the present
- ex-factory sales prices for the same period if possible
- wholesale, retail and international prices
- fertilizer sales by distributor, public, cooperative and private
- imports and exports, including volume, value and importer

Sources of information for the database include a 1993 study by IFDC; a chapter on "Private Sector Distribution and Market Pricing of Agricultural Inputs: Fertilizer, Pesticides, Seeds, and Machinery" by Francesco Goletti in Egypt's Agriculture in a Reform Era; a Chemonics International study (March, 1996) entitled "The Assessment of Fertilizer Supply and Potential for Liberalization and Privatization of Fertilizer Production;" APRP/MVE's Verification Report No. 1 (October, 1997) on Fertilizer Pricing and Distribution in Egypt"; and, APRP/RDI's October 1997 "Marketing and Price Policies for Nitrogen Fertilizer in Egypt."

In the face of the back and forth movement of the past several years it would seem that a baseline period ought to include the period 1994-97 for fertilizer use, and 1996/97 for marketing costs and margins. Some of the specific baseline measures that seem appropriate include:

1) The amount of fertilizer used by farmers on the four major crops, by kilograms of nutrient per hectare;

2) The margin between the ex-factory price or import price, as the case may be, and the retail or producer purchase price in key fertilizer using areas;

3) The percentage of fertilizer sales accounted for by the private sector, by type of fertilizer;

4) The percentage of imports accounted for by the private sector, by fertilizer type;

5) The number of private firms importing fertilizer directly, and their volume, by fertilizer type; and,

6) Number of private firms purchasing fertilizer directly from producing factories, and the volume of their purchases.

The first measure gets at how much crop production has increased as a result of better/cheaper fertilizer availability. The second one is a proxy for how much producer income has changed. The third one is important, but to the extent it has an economic effect, that effect will be picked up by the first two. The same is true of the fourth measure. The fifth and sixth indicators are intended to measure the extent of effective competition within the private sector. The subsector status reports should propose how these different measures will be aggregated into a composite measure of impact for the fertilizer subsector in the event the multi-market model is not developed.

7.1.2 Baseline for Cotton

Import pricing reforms on rice will likely have a major impact on cotton production. Because of the unusually high world prices for cotton in 1995/96, an agricultural production index based on constant beginning year prices will be heavily influenced by this unusual pricing history. For this reason the baseline prices for production indexes should be based on a long-

term average of world market prices (from World Bank or USDA) rather than a single year, especially when the purpose is to measure changes in that index after only three of four years.

Costs of production and input-output data for cotton will have to be obtained from MALR sources, and should be cross checked with CSPP survey data for those governorates where the two overlap. The MALR data review will reveal whether there will be a need for MVE to become directly involved in collecting this data, and if so, what that role might be. At this juncture we recommend planning on needing to develop and implement a supplemental data collection program with MALR extension agents in order to get reliable data.

In terms of variables for measuring impact of the reforms on cotton, the variables will have to cover the entire subsector, from production to ex-factory output of textiles:

1) Cotton production and input use is very relevant, but doesn't mean much unless put in the context of overall agricultural production and input use. There will certainly be shifts in crop production priorities because of the reforms, but evaluating the net effect requires a more comprehensive approach such as the EASM.

2) The composition of seed cotton output (by type and region), and how distribution of the lint from this cotton to domestic spinning and export.

3) The producer sales price of seed cotton as a percentage of the price delivered to the ginnery provides a measure of assembly market margins. If assembly margins decline the farmers share will increase and/or consumer prices will decline.[1]

4) As long as there is significant private sector participation in the ginning industry, then comparing into-gin prices to out-of-gin prices for lint and cotton seed or cotton seed meal should provide a fairly stable measure of the cost of processing for private gins. Trends in this ratio would suggest movement in costs of ginning.[2]

5) The same logic in 4) can be applied at each stage of the production process as long as a significant part of total output is concentrated in a few major products that do not change much in composition over a three year period. The team suggests tracking of into-spinning mill lint cotton prices and ex-factory yarn prices for

[1] In 1996-97 and 1997-98, there was no difference between producer prices, offered at sales rings and into-gin prices. This may well change in 1998-99 as the GOE further liberalizes seed cotton marketing.

[2] Establishing a baseline for estimating ginning costs may be problematic, as ginning charges were fixed by the GOE through 1996-97 and did not reflect real processing costs. Ginning charges will likely increase with continued liberalization of the cotton subsector (as they did from 1996-97 to 1997-98 — from 14.5 LE to 17 LE per lint cotton kentar).

selected varieties and yarn counts.[1] This kind of price data will be available and easier to collect than cost of production data. Of course, the long-run financial viability of agro-industries is a significant potential impact that needs to be assessed. This will require studies of a sample of firms at various stages of the transformation process.

6) Private sector employment and throughput as a percentage of total employment and throughput for ginning, spinning and weaving and manufacturing industries. To the extent that the private sector is more efficient than the public sector, we would expect to see output and employment shift in that direction. These data should be available from employer registries. A sample survey should be conducted to determine the reliability of the firm level data.

7) Output per worker in the textile industry may be a good measure over relatively short periods if there is not much technological change occurring. Even crude indicators may be good enough for showing the impact of industry restructuring.

7.1.3 Baseline for Rice and Wheat

For rice and wheat the measures would be similar to those for cotton. They would include:

1) Production and input use;
2) Farm-gate price as a percentage of the mill price;
3) Into-mill versus ex-mill prices for processed products;
4) Private sector employment and throughput; and,
5) Output per worker, if there is not much technological change occurring.

An important issue to consider is the degree of disaggregation of analysis by firm size/type. Rice and wheat mills vary in technology, scale, capital and labor intensity, and output per worker. In rice processing, Wailes et al. (1995) identified four major types of rice mills.

[1] Fabric and ready-made garments are outputs of the textile industry that would prove to be difficult to track. The inputs and outputs are myriad and heterogeneous. In addition, the private sector already dominates production of fabric and RMGs; this part of the cotton subsector has been more liberalized than spinning, which is dominated by public companies. Domestic weavers, public and private, will face lower input (yarn) costs, as the tariff on imported yarn is relaxed over the next seven years.

7.1.4 Baseline for Food Security

Data for calculating impact measures for this reform area seem to be well in hand via the FSR household budget survey data. The issue of what will be done to get updated data should be addressed now; so should the question of what variables to use for measuring impact. Some that seem good to us:

1) The proportion of food subsidies going to the lowest quarter of the population.

2) Proportion of the population consuming below some nutritional threshold which also shows some type of clinical symptom of nutritional stress. This latter qualification is necessary because measurement error and short-term household disequilibrium will cause a certain number of households to show poorly in the survey, even though they are not at nutritional risk.

7.1.5 Baseline for Privatization and Competition

Baselines for these policy reforms will be picked up in the subsector baselines; if privatization is beneficial for the economy, it will show up in lower costs of production and marketing and greater volume handled by the private sector.

7.1.6 Baseline for Allocative Efficiency

This category of priorities includes nominal protection coefficients as well as allocative efficiency. The baseline for the former can be calculated at any time since it is based on domestic prices, border prices and the exchange rate, all of which are, at least to some extent, historically available. The baseline for allocative efficiency will, hopefully, come from the production data in the FSR EIHS survey. Those data are at least one year earlier in the project life than any newly collected data would be. Alternatively, MALR production cost data may be sufficiently accurate that they can serve as a source of data for this analysis. We won't know the answer to that question until the study of MALR data quality is finished.

7.1.7 Baseline for Water Use Efficiency

The baseline for evaluating water user associations will be provided by GreenCOM, with input from MVE. GreenCOM is open to collaboration with MVE in this study. Because not much is known about how water user associations are functioning, appropriate baseline measures are not readily apparent to the team. However, they will certainly present themselves as planning for the study unfolds. This study is an opportunity to gather data on the impact of the reforms on water use efficiency issues in the shorter-term.

7.2 MVE Studies Required To Set Baseline/Predict Impact

Until the subsector status reports are completed by MVE or MVE consultants, the exact nature of what additional data will need to be collected and how it will need to be collected cannot be answered definitively. In all likelihood, however, they will include most of the following

1) A study of MALR data collection scope and methods at the district-level and above. This would also include an assessment of the reliability of production and price data collected by MALR, using consistency checks across levels of data collection (district vs. governorate), analysis of trends and inter-year variability, etc. This would be carried out by MVE, hopefully someone who speaks Arabic fluently.

2) Evaluation of the IFPRI EIHS production data and, if adequate, use of the data to estimate producer supply elasticities, allocative efficiency, factor productivity and construct input-output data for the EASM.

3) On-going subsector studies relating to fertilizer, cotton, wheat and rice marketing and processing, including periodic gathering of price data for these commodities. Establishing baseline data for commodity prices and trade will require obtaining and examining data from CAPMAS and MTS.

4) Collaboration with RDI for data collection for the EASM.

5) Development of the Multi-market Model.

6) Use of these models to predict the impact of the various reforms, *ex ante*, and assess the impact *ex post*.

7) Collection of supplementary cost of production data through the Acreage Authority or extension service of the MALR. The scope of this study will be determined by the results of the MALR data quality study described in 1) above, in conjunction with an assessment of the quality of FSR EIHS production data.

8) Shift-share analysis of MALR time series regional crop production data, if the MALR data quality survey determines that the data are of sufficiently good quality to support such an analysis. In all likelihood, they are. This study needs to be done only once, at the end of the project since all historical data will be available at that time.

9) Evaluation of attitudes regarding water user associations in conjunction with Green-ComIII.

7.3 Studies Required for Tracking Impacts

Most of these studies will be conducted during the last 12 months of the project. They will be much more limited in scope than the initial studies, will benefit from having been done at least once before, and should, therefore, be executable in a fairly short time in comparison to the baseline surveys. They will include:

1) Subsector reviews of targeted variables (variables reflecting impacts), i.e., only the critical variables in the priority subsectors. Because these will have been identified and followed for quite some time by the end of the project, we expect these reviews to involve a single survey per subsector, very focussed on the baseline measures.

There would be no reason to collect any more data than this since the project will be ending. We expect data collection for each subsector to take no more than two months, with the possibility of combining more than one subsector in a single survey. Data collection would begin about nine months prior to the end of the project, using questionnaires and analysis programs adapted from the baseline surveys for the same subsector.

2) A household income, expenditure and consumption survey similar to the one done by FSR for baseline data. USAID should decide now whether to amend the IFPRI contract and work plan to include a rerun, or have MVE assume responsibility for this. The data will have to be collected by someone. Having done it once before, IFPRI certainly seems to be the logical choice.

3) A cost of production study: a new and accurate study needs to be done of crop production and input use for re-validating the agricultural sector and multi-market models, and for documenting the extent to which the reforms are having an impact on production. Whether to use data from the IFPRI study of producers orthe MALR extension service data will depend on the results of the analysis of each during the baseline phase. Obviously, if the IFPRI methodology proves adequate for the baseline data, or can be easily modified to be adequate, it would make sense to combine the production and expenditure surveys as was done initially.

4) Re-run the agricultural sector and multi-market models to assess the impacts of the policy reforms *ex post*. We estimate this will take about two months to revalidate the models and produce the results.

5) Collaborate with GreenCOM in re-run of the KAP study of farmers to learn of changes in the number of water user associations and in perceptions of water availabilities between head-enders and tail-enders.

7.4 Implementation Calendar

The table on the next page contains the implementation calendar for the proposed studies, including who will collaborate with the MVE in their execution. The shaded areas indicate ongoing activities rather than discrete studies. They will serve both the monitoring and the impact assessment goals of the APRP.

According to the calendar, most of the discrete data collection activities will be complete by the end of the first quarter of 1998. The analysis of the data will go beyond the first quarter, but the data itself will have been collected and fixed in time. Field work for the follow-up studies will begin in the third quarter of 1999. This will probably be necessary in order to collect and analyze the data by the anticipated end of project in June, 2000. The time in between will be spent completing analysis of the baseline data, monitoring the benchmarks, and preparing the follow-up surveys, including modifying data tabulation programs if required, so they can be executed quickly. It may be possible to hold off on the follow-up surveys until September, 1999, but that will not be known until MVE gets closer to the end of the project and sees how much it is able to prepare for their execution in advance. Ideally, MVE unit

would continue its work during the year following the end of the project. This allows more time for the effects to be felt, and counts all of them right up to the end of the project, instead of 9-12 months earlier. That could add another 25% to the magnitude of documented benefits arising from the reforms.

7.5 Implementation of the Decision Tree

Table 3 summarizes the proposed studies in the form of a decision tree so as to show how the studies fit together in time, and how subsequent studies depend on the results of earlier studies. The numbers in the lefthand column refer to the sequence of the action.

Table 3: Decision Tree for MVE Surveys

1- Evaluate FSR/EIHS demand elasticities for multi-market model and income impact studies. If OK, go to 5, if not 2	Evaluate quality of FSR/EIHS production data for suitability for:	Conduct study of coverage, quality and suitability of MALR and CSPP production and input data for	Complete subsector status reports for cotton, wheat, rice, cotton, fertilizer, and food security.
2- Contract with CAPMAS for demand elasticities.	- Baseline measures for production data and input use. - Estimating supply elasticities. - TFP Analysis. - Input-output data for EASM. - Shift-share analysis. - Obtaining end-of-project production and input data.		- Identify market structure and policy reform issues requiring added study. - Identify specific measures to use for assessing impact. - Establishing baseline values for impact measures. - Identify additional data needed to establish baseline. - Identify additional studies to understand market performance and assess impact of reforms.
3-	Conduct additional survey to get baseline production and input data if necessary.		Conduct surveys required to obtain missing baseline data. Conduct/collaborate on remaining studies of fertilizer, cotton, rice, wheat, agribusiness, employment for understanding sub-sector and impact of reforms.
4-	Update EASM, produce supply elasticities for multi-market model if necessary. Develop and run model for TFP analysis.		Continue to monitor changes in baseline measures for impact variables. Analyze nominal protection coefficients.
5- If data are forthcoming, develop and test multi-market model.	If data are suitable, prepare shift-share analysis.		
6-	Obtain end-of-project production and input data using method chosen in 2 above.		Conduct surveys to collect end-of-project data for priority subsectors.
7-	If necessary, recalibrate the EASM and rerun with end-of-project data.		Complete subsector impact assessments using data from targeted studies.
8- Recalibrate multi market model, if used and necessary prepare end-of-project run.			

PERSONS CONTACTED

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SELECTED BIBLIOGRAPHY

Abdel-Hamid Youssef Saad and Abdel Rahman Taryal. October, 1997. ***Fertilizer Pricing and Distribution in Egypt***. APRP/MVE Verification Report No. 1, Cairo

Abla, M.Abdl-Latif. 1997. ***A Detailed Review of the Policy Environment of Wheat in the Period 1987 - 1996,*** APRP/FSRU.

Abt Associates Inc. 1996. "Monitoring, Verification and Evaluation Unit (MVE) Technical Proposal". Submitted to USAID May 28, 1996. Bethesda, Maryland.

Ahmed, 1983. ***"Indonesian Agricultural Productivity and its Relation to Development Strategy. A Value Added Approach".*** Unpublished Ph. D. Dissertation, University of Florida, Gainesville, 1983.

ALCOTEXA. 1996 - 97. Nos. 106-108 (Jan. and Oct. 1996, April 1997). ***The Egyptian Cotton Gazette***. Journal of Alexandria Cotton Exporters' Association. The **Gazette** contains annual time-series data on lint cotton supply and utilization and export prices by variety. It is issued twice a year.

Ariza-Nino, Edgar and Ibrahim Siddik. December 1997. ***Assessment of Market Information Needs of an Open and Competitive Agricultural Marketing System: Marketing Information Sources for Selected Agricultural Products and Inputs in Egypt.*** APRP/RDI Unit No. 23, Cairo.

Ariza-Nino, Edgar, Ibrahim Siddik and Kenneth Swanberg. July 1997. ***Impact Simulation of Government Cotton Pricing Decisions in Egypt.*** APRP/RDI Report No. 12, Cairo, Egypt.

Amer Jabarin. September 1997. ***ATUT Horticulture Program Monitoring and Evaluation Plan: Baseline Study and the First Annual Monitoring Report***. Draft report not available for distribution.

Ariza-Nino, Edgar, Ibrahim Siddik and Kenneth Swanberg. May 1997. ***A Deficiency Payment Mechanism for Supporting Cotton Floor Prices, 1997/98 Crop Season***. APRP/RDI, Unit Report No. 13, Cairo, Egypt.

ATUT/RONCO. August 1996. ***Master Strategic Action Plan: Egyptian Horticulture Export Industry, August 1996-September 1997.*** ATUT/RONCO Publication No. 1.

ATUT, Marketing and Technology Information Unit (MTI). March 1997. ***Fresh Mangoes Data Report.***

Badiane, Ousmane et al. April 1997. ***Wheat Policy Reform in Egypt: Adjustments of Local Markets and Options for Further Reforms***. IFPRI/FSRU in collaboration with MALR and MTS.

Baffes, J. and Madhur Gautam. 1996. "Price Responsiveness, Efficiency and the Impacts of Structural Adjustment on Egyptian Agricultural Production." **World Development**, 24 (4:765-771).

Ball, "*Output, Input, and Productivity Measurement in U. S. Agriculture, 1948-79,*" **American Journal of Agricultural Economics**, 67, pp. 475-86, 1985.

Bartsch, Ulrich. (ca:1996) *Structural Reforms and Poverty: A CGE Analysis of Cotton Policy Options in Egypt*. D. Phil. Thesis. University of Sussex, U.K.

Bender, Filmore. December 1997. ***Updating the Agricultural Sector Model: A Final Trip Report.*** APRP/RDI Unit Report No. 25, Cairo.

Bouis, H.E., R.H. Adams and A.U. Ahmed. July 1997. **The Egyptian Food Subsidy System: Impacts on the Poor and an Evaluation of Alternatives for Policy Reform,** IFPRI/FSRU of the APRP in Egypt, in coll. with MALR and MTS, Cairo, Egypt

Cardiff, Patrick W. 1997. **The 1995/1996 Household Income, Expenditure and Consumption Survey: Final Analysis Report.** USAID/Egypt and US Bureau of the Census; Cairo and Washington.

Casley, D.J. and D. A. Lury. 1987. **Data Collection in Developing Countries**. Second Edition, Oxford and New York, Oxford University Press, 1987

Casley, D.J. and K. Kumar, 1988. **The Collection, Analysis and Use of Monitoring and Evaluation Data.** Baltimore, Johns Hopkins University Press for the World Bank.

Castelar, "*Productivity Change in the Brazilian Agricultural Sector*", Unpublished Ph. D. Dissertation, University of Florida, Gainesville, 1983.

Chemonics International. March, 1996. ***The Assessment of Fertilizer Supply and Potential for Liberalization and Privatization of Fertilizer Production.*** Prepared for USAID/Cairo.

Datt, G., D. Jolliffe and M. Sharma, July 1997. **A Profile of Poverty in Egypt: 1997.** IFPRI/FSRU in collaboration with MALR and MTS, Cairo, Egypt.

Datt, Gaurav and Jennifer Olmsted. July 1997. **Agricultural Wages and Food Prices in Egypt: A Governorate-Level Analysis for 1976-1993.**

El-Saadany, Rashad. 1997. **Study on Support Price Policy.** Cairo, Egyptian-German Cotton Sector Promotion Program (CSPP).

Elsayed Dahmoush, Waheed Mogahid and Edgar Ariza-Nino. November 1997. ***Feasibility of Eliminating Tariff and Non-Tariff Barriers on Imports of Cotton Yarn.*** APRP/RDI, Unit Report No, 18, Cairo.

Ehrich, Rollo L. and Gamal Siam. August 1997. ***Rice Prices and Trade: A Policy Brief.*** DEPRA Project (Development Economic Policy Reform Analysis Project). Ministry of Trade and Supply, Cairo, Eygpt.

Esfahani, Hadi Salehi. 1987. "Technical Change, Employment and Supply Response of Agriculture in the Nile Delta," **Journal of Development Economics**, 25 167-196.

Fletcher, Lehman B. March 1997. "Agricultural Policy Reform Program: Policy Goals, Program Objectives and Progress Indicators". Matrix developed for USAID/Cairo.

Fletcher, Lehman B. and Karl F. Jensen, 1996. ***Agricultural Production and Credit Project: A Final Assessment***. DATEX. Falls Church.

Fletcher, Lehman B. 1996. **Egypt's Agriculture in a Reform Era**. Iowa State University Press, Ames, Iowa.

Freeman, D. M. 1989. ***Organizations for Social Development: Concepts and Cases of Irrigation Organization***. Boulder, CO, Westview Press.

Gallacher, Marcos, Stephan J. Goetz and David L. Debertin. 1994. "*Managerial Form, Ownership and Efficiency: A Case Study of Argentine Agriculture,*" **Agricultural Economics** 11 289-99.

Gleason, Jane and Sayed Hussein. June 1997. ***Study on the Economic and Technical Feasibility of Introducing New Types of Short Season Cotton Varieties.*** APRP/RDI, Cairo, Egypt.

Goetz, Stephan J. 1995. **"Markets, Transaction Costs and Selectivity Models in Economic Development,"** Chap. 17 in Gregory J. Scott, editor, *Prices, Products and People: Analyzing Agricultural Markets in Developing Countries*, Colorado: Lynne Rienner Publishers, Inc., 383-402.

Goletti, Francesco. 1996. "Private Sector Distribution and Market Pricing of Agricultural Inputs: Fertilizer, Pesticides, Seeds, and Machinery" in **Egypt's Agriculture in a Reform Era**, edited by L.H. Fletcher, Iowa State University Press, Ames, Iowa.

GreenCOM Egypt III. October 1997 **INCEPTION REPORT: Implementing a MPWWR Participatory Communication Program for Supporting Water Policy Formulation and Implementation.** Chemonics International, Cairo.

GreenCOM Egypt III. October, 1997. Survey Design for Study of District Engineers' Knowledge, Attitudes and Practice. Cairo.

Harrison, K. M., et al. , April, 1994. **New Lands Development Study.** Analysis of the Egyptian Food Marketing System with Special Reference to the New Lands. NARP, Cairo.

Hauver. 1989. **Major Statistical Series of the US Department of Agriculture**," Volume 2; Agricultural Handbook No. 71:2, Washington, D.C.

Hazell, P. B. R. and R. D. Norton. 1986. ***Mathematical Programming for Economic Analysis in Agriculture***. MacMillan, New York.

Hazell, Peter, N. Perez, Gamal Siam and Ibrahim Soliman. Sept. 1994. "Effects of Deregulating the Agricultural Production Sector on Food Availability and Resource Use in Egypt". Mimeo´ International Food Policy Research Institute, Washington DC.

Herrmann, Roland. 1997. "Agricultural Policies, Macroeconomic Policies, and Producer Prices Incentives in Developing Countries: Cross-Country Results for Major Crops." **The Journal of Developing Areas**. 31(Winter)203-220.

IBTCI. August 1997. ***Capital Markets Growth and Development Study.*** Special Study for the Privatization Program in Egypt. Garden City, Cairo.

IBTCI, ***Semi-Annual Evaluation/Quarterly Review, January-June 1997***. USAID Privatization Project Evaluation Services Contract. Garden City, Cairo.

IFDC, 1993. ***Fertilizer Policy Impact Study.*** Prepared for USAID/Cairo and the GOE. Muscle Shoals, Alabama.

IFPRI/FSRU, ***Work Plan for the Period 1997 to 1999.*** Submitted to the Program Planning Committee of the Agricultural Policy Reform Program in Egypt, Cairo, Egypt, August 1997.

IFPRI/FSRU, 1997. **Egypt Integrated Household Survey (EIHS).** Accompanied by *Interviewer Manual*.

Kamarck, A. M. 1983. **Economics and the Real World**. Philadelphia, University of Pennsylvania Press.

Keller, Andrew and Jack Keller. 1995. "Effective Efficiency: A Water Use Efficiency Concept for Allocating Freshwater Resources." Environmental and Natural Resources Policy and Training Project (Winrock), Discussion Paper #22, Water Research Center, Ministry of Water Resources and Public Works and USAID, Cairo.

Khattab, Mokhtar, Gamal M. Siam, Heba El-Lathy, Ahmed Abu Taleb, Mona Aboul Kheir, Alia Al-Bahrawy, Mohamed Ramadan, Tarek Naweir, Mohamed Seddik and Khalid Shaurawy. 1996. "A Multimarket Model for Food Security Analysis in Egypt. Final Report." The Cabinet, Information and Decision Support Center, and Food and Agriculture Organization, Cairo, Egypt.

Koester, U. Bruner S. 1997. **Study on Cotton Price Policy.** Cairo, Egyptian-German Cotton Sector Promotion Program (CSPP), Zamalek, Cairo.

Krenz, Ronald D. 1996. ***A Comparison of the Returns from Cotton Seed and Alternatives Crops (1991 Versus 1995***). Project Report No. 16. Egyptian-German Cotton Sector Promotion Program (CSPP), Zamalek, Cairo.

Krenz, Ronald. June 1997. ***Liberalization of Cotton Marketing in Egypt, 1993-97.*** Project Report No. 41. Egyptian-German Cotton Sector Promotion Program (CSPP), Zamalek, Cairo.

Krenz, Ronald. May 1997. ***Marketing of Seed Cotton, 1996-97 Season: Results of a Producer Survey***. Project Report No. 17. Egyptian-German Cotton Sector Promotion Program (CSPP) c/o GTZ-Pas, 4d, El-Gezira St., Zamalek, Cairo.

Krenz, Ronald D., 1996. "Recommendations for Monitoring and Verification of Policy Reforms". DATEX, Arlington, Virginia.

Krenz, Ronald D., Mohammed K. Rihan and Mamdouh Nasr. May 1997. ***Rice Subsector Maps for the 1996-97 Marketing Season.*** Draft report only; not available for distribution.

Krenz, Ronald, Kenneth Swanberg and Fatma Khattab. September 1997. ***Cotton Subsector Map.*** APRP/RDI Unit Report No. 14, Cairo, Egypt.

Krueger, Anne, Maurice Schiff, and Alberto Valdés. 1988. "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economywide Policies." **World Bank Economic Review**, 2 255-272.

Lofgren, Hans. 1994. "A Social Accounting Matrix for Egypt." Economics Department, American University in Cairo.

Mahmoud Ibrahim, Fatma Khattab, and Kenneth Swanberg. September 1997. ***The Public Sector Spinning and Weaving Industry, Egypt as of June 30, 1997: A Status Report and Analysis.*** APRP/RDI Unit Report No. 11, Cairo.

Magdy el Guindi, Ibrahim Siddik and Edgar Ariza-Nino. December 1997. ***Marketing and Price Policies for Nitrogen Fertilizer in Egypt.*** APRP/RDI Unit Report No. 22, Cairo.

MALR, USAID, NARP, New Initiatives Component, 1994. ***New Lands Development Study***, Volume (1). Main Report Cairo, Egypt.

MALR, 1997. **Egypt Integrated Household Survey -- Household Questionnaire: Male (and Female).** APRP/FSRU.

Ministry of International Cooperation, Sector Policy Reform Unit, "Comparative Presentation of the IMF and USAID Reform Program," no date, Cairo, Egypt, 26 pp.

Morgenstern, O. 1963. ***The Accuracy of Economic Observations***. *Second Edition*. Princeton, Princeton University Press.

MVE. July, 1997. **Verification Report, APRP, Tranche I, Policy Benchmarks for Accomplishment by June 30, 1997.** The Government of Egypt, USAID.

Nassar, Saad, Fenton B. Sands, Mohamed A. Omran and Ronald Krenz. 1996. "Crop Production Responses to the Agricultural Policy Reforms" in **Egypt's Agriculture in a Reform Era.** Edited by L.B. Fletcher, Iowa State University Press, Ames, Iowa.

Omran, Mohammed A.S. 1997. *The Impact of the Liberalization of Agricultural Input and Output Prices on the Cropping Pattern.* Ph.D dissertation. Department of Agricultural Economics, Suez Canal University.

Ouedraogo, Ismael and Abdel-Rahim Ismail. October 1997. ***Progress and Obstacles in Rice Subsector Liberalization in Egypt: A Rapid Appraisal to Verify Policy Benchmarks.*** Verification Report No. 4.

Parks, Loren and et al. May 1997. ***Phytosanitary Regulation of Cotton Lint Imports into Egypt.*** APRP/RDI/GTZ. Cairo, Egypt. (This study was jointly funded and executed with RDI).

Ragaa, El-Amir, Hamdi Salem and Eric Wailes. March 1996. ***Analysis of Egypt's Rice Marketing System, Final Draft Report.*** *Contract No. 263-0255-C-00-5045-00.* USAID/Cairo, DATEX Inc. Arlington, VA.

Raulerson, Richard and Max Laugham. 1970. "Evaluating Supply Control Policies for Frozen Concentrated Orange Juice with an Industrial Dynamics Model," **American Journal of Agricultural Economics**, 52 197-208.

Robinson, Sherman and Clemen Gehlhar. 1994. "Land, Water and Agriculture in Egypt: the Economywide Impact of Policy Reform" in **Maintaining Food Security in Egypt During and After Agricultural and Food Policy Reform.** MALR and IFPRI, Cairo and Washington, D.C.

Ruddy, Vincent and Melvin, Spence. March 1997. ***Liberalization and Privatization in the Cotton and Rice Subsectors: the Roadmap to Procedural and Regulatory Reform.*** APRP/RDI Unit Report No. 6, Cairo, Egypt.

P. Salant and D. Dillman, 1994. **How to Conduct your Own Survey**. Wiley, New York.

Sawsan El-Messiri. 1997. ***Gender Impacts of ATUT.*** International Development Consultancy Services. Dokki, Cairo, Egypt.

Sadoulet, Elisabeth and Alain de Janvry. 1995. **Quantitative Development Policy Analysis**. John Hopkins University Press, Baltimore.

Sedeik, M., M. Ramadan, A. Bahrawy, M. AbulKheir, M. Khattab, G. Baghdady, H. Leithy and A. Abutaleb. No date. "A Dynamic Model for Food Security in Egypt." Information and Decision Supprt Center (IDSC), Cairo, Egypt and Cairo University, Giza, Egypt.

Sedeik, S., M. Ramadan, T. Nowere and A. Abutaleb. No date. "The Impact of Tariff Reduction on the Egyptian Economy: A CGE Analysis." Information and Decision Supprt Center (IDSC), Cairo, Egypt and Cairo University, Giza, Egypt.

Textile and Clothing Consultants bv. February 1997. ***Restructuring of National Spinning & Weaving Co. and Port Said Spinning & Weaving Co. and The Egyptian Wool Spinning & Weaving Co. "WOOLTEX": Presentation of Recommendations***. Prepared for Government of Egypt Social Fund for Development and the Office of the Holding Co. for Textile Manufacturing & Trade.

Textile and Clothing Consultants bv. December 1996. ***Restructuring of ESCO, Cairo: Business Plan***. Prepared for the Social Fund for Development, Government of Egypt. Cairo.

Textile and Clothing Consultants bv. December 1996. ***Restructuring of Middle Egypt Spinning & Weaving Co. and Upper Egypt Spinning & Weaving Co.: Presentation of Recommendations***. Prepared for Government of Egypt Social Fund for Development and for Office of the Holding Co. for Cotton and International Trade.

USAID, December 1996. **United States Economic Assistance to Egypt**, Status Report.

Vercueil, J. 1985. **CAPPA: Technical Description´ (Computerized System for Agriculture and Population Planning Assistance and Training).** Food and Agriculture Organization, United Nations, Rome.

Vernon, John, Norfleet Rives, and Thomas Naylor. 1969. "An Econometric Model of the Tobacco Leaf Industry," **Review of Economics and Statistics,** 51 149-158.

Wailes, Eric. April 1995. ***The Uruguay Round of GATT: Potential Opportunities for Egypt.*** Presented at the Workshop: Prospects for Egypt in the International Rice Market. Center for Agricultural and Rural Development Food and Agricultural Policy Research Institute Iowa State University, Ames. Iowa, USA, Agribusiness Research and Training Center, Higher Institute of Agricultural Cooperation, Shoubra El Khima, Egypt.

Wailes, Eric et al. March 1995. ***Impacts of Agricultural Policy Reforms on Rice Production, Milling, Marketing, and Trade in Egypt.*** Department of Agricultural Economics and Rural Sociology, University of Arkansas, Fayetteville.

Westhoff, Patrik, Robert Baur, Deborah Stephens, and Williams Meyers, 1990. *FAPRI U.S. **Crops Model Documentation***. Iowa State University, Center for Agricultural and Rural Development, Technical Report 90-TR 17.

Williams, H. P. 1990. **Model Building in Mathematical Programming**, 3rd. ed. New York, Wiley.

APPENDIX A
DETAILS OF MODELING TECHNIQUES

1. THE MULTI-MARKET MODEL

Compared with the Egyptian Agricultural Sector Model (EASM), the multi-market model will contain less detail on specific production practices and constraints in different regions of Egypt, including the economics of water use, but more detail and realism on the input marketing, income and consumption sides, including feedback effects of changes in income. In fact, the EASM presently captures input and output demand relationships in only a rudimentary fashion, since it was designed primarily to study water and acreage allocation decisions.

1.1 How the Multi-market Model Works

The multi-market model integrates input and output supply and demand elasticities within a system of linear or non-linear simultaneous equations. It captures market interactions for all inputs and outputs in the agricultural sector. Suppose the multi-market model is to be used to evaluate the impact of a reduction in consumer rice prices by 10 percent. Just as in the case of the causal chain illustrated for rice price policy discussed above (which can also be simulated using the multi-market model), the change in the rice price changes producer and consumer incentives in a number of ways, and has implications for income distribution, employment, the GOE's budget in addition to suppliers of agricultural inputs and farmers and consumers.

If rice prices fall, consumers will increase their consumption of rice and complementary foods, and decrease the consumption of substitutes, such as wheat-based products. These effects are captured by the price elasticities in the consumer demand system (specifically, in the demand curve for rice, which has as explanatory variables income-, own- and cross-price elasticities of food products). In the demand curve for wheat-based products, the rice-wheat cross-price elasticity causes wheat consumption to decline in favor of the now cheaper rice. The consumption of all other foods which are sensitive to rice prices adjusts in a similar manner, as captured by the elasticities in the consumer demand system. In addition, the 10 percent reduction in rice prices translates into a higher real income for consumers of rice. The increase in real income is proportional to the weight of rice consumption in the consumer's overall food basket. It is possible to calculate by how much the real income of individuals in different income groups increases. Also, to the extent that wheat consumption declines, GOE spending on wheat subsidies declines.

The reduced consumer price of rice is transmitted through the marketing system to producers of rice, causing them to adjust production plans. In particular, the lower price of rice is translated through the supply elasticity into lower rice production levels, and increases in the production of competing crops and reductions in complementary crops (primarily those grown in rotations) through the appropriate supply elasticities. This occurs through the supply functions for other crops, which incorporate the cross-price elasticity of rice. Similarly, it is possible to calculate net real income effects on different classes of rice producers, as is done for consumers in urban areas. To the extent that demand functions are available for resources (inputs) used in rice production, it will also be possible to estimate welfare effects for owners of those resources.

As privatization and free markets become more widespread in the agroprocessing/agri-business sector, and as MVE gains more in-depth knowledge about individual subsectors, we

recommend that the model be expanded to capture value-added activities in agricultural processing particularly for cotton but also for other commodities involving extensive processing. With crop-specific industry models that are specified in a recursive manner, the flow of information through the various subsectors is simulated explicitly, thereby tracing out the causal chains associated with various policies. For example, using a recursive multi-market model of the wheat subsector, MVE can first examine the effect of changes in wheat and rice consumption, resulting from reduced rice tariffs, on agribusinesses involved in wheat processing. Second, MVE can examine the effect of changes at the wheat processing level on wheat production and wheat farmers. Last, MVE would examine the impact of these changes on individuals supplying factors of production to wheat farmers. In this manner, causality is established starting from a policy change at the consumer level down to owners of resources used in wheat production. At each level in the multi-market system, detailed effects of the initial policy are identified, and the flow of information through the subsector--as well as related subsectors--is also tracked. The reverse causality, from producers to consumers, can similarly be traced through any commodity subsector. For example, the effect of a productivity-enhancing technological breakthrough in rice production on processors, middlemen and -women and final consumers can be studied. These kinds of industry/subsector causal policy chains have been successfully modeled for, among other products, citrus products and tobacco leafs (Raulerson and Laugham, 1970; and Vernon, Rives and Naylor, 1969; also see Westhoff, Baur, Stephens and Meyers, 1990 for a more recent extension).

Unlike the Computable General Equilibrium (CGE) model, the multi-market approach is nevertheless sectoral. For policy questions and analyses involving significant impacts *between* sectors of the Egyptian economy (such as energy, tourism, finance, etc.), the CGE is a preferred tool, as discussed in more detail in section A.2. As one attempts to disaggregate the CGE model to study more specific policy impacts, however, two difficulties arise: (a) the number of elasticities which have to be "guesstimated" increases and (b) the policy implications become increasing intractable and difficult to interpret. Thus the multi-market model offers more sector detail than the CGE, but this comes at the cost of abstracting from inter-sectoral or economy-wide linkages. Ideally, the multi-market model is used as a complement to the CGE, rather than a substitute. Each of the three analytical models (EASM, multi-market and CGE) reviewed here offers specific strengths and weaknesses, is most suited to answering some but not other questions, and needs to be viewed as one tool in the overall analytical toolkit, with each model's applicability depending on the question or policy analysis on hand.

1.2 Details on Developing the Multi-market Model

The most cost-effective way for MVE/RDI to develop this multi-market model is as follows (first step). According to its work plan, the IFPRI team will produce a complete consumer demand system by March 1998, using data from its household budget survey. This will yield own-price, cross-price and expenditure elasticities of demand for the following items: subsidized *baladi*, subsidized wheat, free wheat, *fino* bread, rice, other cereal, oil sugar, pulses, vegetables, fruits, meat, eggs and milk, condiments, beverages and non-foods. Judging from earlier work (Bouis, Adams and Ahmed, July 1997), separate elasticities will be estimated for four different groups: the 40% of poorest households in rural and urban areas, and the 60% of wealthiest households in rural and urban areas. These elasticities provide a useful starting point for building the multi-market model and giving MVE/RDI experience in working with the model.

The EASM, which will be updated by RDI and Dr. Filmore Bender before the end of 1997, will serve as a source of synthetic producer supply elasticities for eight regions of Egypt, including the New Lands, and the following crops: *berseem*, maize, barley, lentils, flax, favabeans, wheat, onion, tomato, vegetables, other legumes, sesame, soybeans, potato, citrus, sugarcane, alfalfa, rice and cotton. Additional detail is available from the agricultural sector model, including seasonal breakdowns as well as varietal disaggregation, and preliminary simulations will reveal what types of commodity groupings are most sensible and relevant for policy analysis, as reflected in the magnitudes of the elasticities. The preliminary simulations necessary to generate supply elasticities should take no more than one month, so that coefficients will be available by March 1998 for use with the IFPRI consumption data to construct the multi-market model. Development of the multi-market model will also benefit from insights gained through the MVE subsector studies planned or currently under way, particularly at the processor level.

Once the initial model has been tested, and key elasticities which have particularly pronounced effects on model results are identified, MVE/RDI may consider refining the elasticity estimates using additional data sources. This second step will not be necessary if the basic multi-market model is deemed adequate for the purposes at hand; however, MVE should still make use of the FSR survey data to collect baseline information on farm-level production and input use, as discussed below. There are three different sources for obtaining data to estimate elasticities: 1. the IFPRI agricultural production data from the household survey; 2. official Ministry of Agriculture production statistics covering various Governorates and multiple years (time series data); and 3. the CAPMAS household budget data. Items 1. and 2. will serve as independent checks on the supply elasticities, while item 3. can be used to verify the demand elasticities obtained from the IFPRI household surveys. These are discussed in more detail in Appendix B.

1. At present, IFPRI plans to release all of the survey data by January 1998, but does not intend to analyze the agricultural production data under the existing work plan. Analysis of the IFPRI production data to estimate profit and supply functions has the additional advantage of providing insights into farm-level decision making, and will also provide answers to questions about producer technical and allocative efficiency, which are important issues for USAID. Given the importance of the private sector efficiency goal in USAID's SO #1, the Planning Team recommends that MVE consider allocating approximately 6 months of STTA to the analysis of IFPRI's producer data. This amount of time is needed to generate producer elasticities, conduct tests of allocative and productive efficiency, and generate equations predicting input use by farmers, in addition to constructing pre-reform baseline estimates for input use and constraints faced by farmers in obtaining credit and inputs.

The IFPRI Egypt Integrated Household Surveys (EIHS) provide one detailed cross-sectional snapshot of input use, production and consumption relationships in rural, urban and metro Egypt, including a distinction between Lower and Upper Egypt. At present there is some discussion of a repeat consumption survey of the same households by IFPRI; the resulting panel data would permit the estimation of random/fixed effects econometric models which will in turn increase the precision of the estimated supply and demand coefficients, in addition to capturing consumption variability (if any) over time. However, the initial survey results are useful even if this second survey is not carried out. It appears unlikely, however, that IFPRI will conduct another round of complete household-level surveys, unless it is also given adequate resources to analyze the data collected.

2. The official source for agricultural production data, which can be used to estimate supply elasticities, is the Ministry of Agriculture. The data needed from this source are time series, Governorate-level data on planted area, prices, yield and production costs, covering up to 21 crops (for *berseem*, only per *feddan* revenues are available; no data are reported by the MOA for prices and yields). As a minimum, data are available for six Governorates in the Nile Delta region (accounting for over one-half of the value of all crops produced in Egypt) starting in the year 1965; crops aggregated into *berseem*, cotton, wheat, other winter crops, summer maize, rice, other summer crops, and other *Nile* crops; and inputs of fertilizer, mechanical power, irrigation or drainage, and other agricultural inputs (see Esfahani, 1987). By pooling cross-sectional and time series data, greater precision is achieved in estimating parameters, and the use of lagged dependent variables for quantities produced makes the model estimated from such data especially well-suited for forecasting. Estimated (STTA) time required to generate producer supply elasticities (once all data are collected): 2-3 person-months.

3. On the consumer side, the expenditure survey by CAPMAS in 1990-91 and in 1995 of over 14,000 households represents another important data source. While questions arise about the quality of the data, this data set has the advantage of providing consumption patterns over an entire year. The Information and Decision Support Center (IDSC) has used the 1990-91 data set to estimate own-price, cross-price and expenditure elasticities for Egyptian households. Estimated time required to generate consumer demand elasticities (once all data are collected or assuming CAPMAS carries out the estimation): 2-3 person months.

1.3 Outline of a Multi-market Model (Example)

1. *Output supply and factor demand equations (farm-level)*

A supply equation is estimated for each farm product (wheat, rice, *berseem*, etc.) and one input demand equation is estimated for each purchased input (fertilizer, seed, insecticide, hired labor). Output supplies and factor demands are functions of prices of all inputs and outputs produced, as well as variables which are fixed at the household level (i.e., the shifters). For example, the supply equations for wheat and rice may be written as:

$$dq_w^s/q_w^s = e_{ww}(dp_w/p_w) + e_{wr}(dp_r/p_r) + e_{wl}(dp_l/p_l) + e_{wf}(dp_f/p_f) + e_{wE}(dE/E)$$

and

$$dq_r^s/q_r^s = e_{rw}(dp_w/p_w) + e_{rr}(dp_r/p_r) + e_{rl}(dp_l/p_l) + e_{rf}(dp_f/p_f) + e_{rE}(dE/E)$$

where q^s is quantity supplied, e refers to elasticities, p is prices, E is a fixed factor such as educational attainment, and subscripts are as follows: w is wheat, r is rice, l is labor and f is fertilizer. Thus, e_{rw} refers to the supply response or elasticity of rice output to changes in wheat prices. The letter "d" is the change operator, so that dq_{ws}/q_{ws} measures relative change in the quantity of wheat supplied. When quantities are log-linearized in this manner, changes in policy variables are translated into changes in impact (dependent) variables through the relevant elasticity, and only policy variables which actually change need to be included in the simulation. For example, a change in fertilizer prices, (dp_f/p_f), is translated into a change in the quantity of wheat supplied by farmers (dq_w^s/q_w^s), with the magnitude of the change depending on the elasticity, e_{wf}.

In addition, elasticities and changes in prices of other competing and complementary products and purchased inputs would need to be included to arrive at a complete multi-market model. Also, similar equations are derived for each of the other important crops grown in Egypt, with their corresponding supply elasticities (including elasticities with respect to wheat and rice prices).

The derived demand for inputs is modeled using the same set of variables. For example, the quantity of farm labor demanded (q_l^d) is:

$$dq_l^d/q_l^d = e'_{lw}(dp_w/p_w) + e'_{lr}(dp_r/p_r) + e'_{ll}(dp_l/p_l) + e'_{lf}(dp_f/p_f) + e'_{lE}(dE/E)$$

where e' denotes a demand elasticity, e'_{ll} is the own-price elasticity of demand for labor and e'_{lf} is the cross-price elasticity of demand for labor with respect to fertilizer prices. In similar fashion, input demand functions can be derived for each of the other purchased inputs used on the farm, including fertilizer, insecticides and seed.

2. *Factor supplies*

A supply equation is estimated for each factor of production, including household labor, and for purchased inputs (such as fertilizer), where applicable. These factor supplies are again a function of all relevant prices as well as shifters. For example, the equation for household supply of labor is:

$$dq_l^s/q_l^s = e_{lw}(dp_w/p_w) + e_{lr}(dp_r/p_r) + e_{ll}(dp_l/p_l) + e_{lf}(dp_f/p_f) + e_{lE}(dF/F)$$

where each elasticity now denotes a factor supply rather than demand elasticity, and F is a fixed factor (perhaps age of the household head) affecting labor supply.

3. *Household consumption demand and income*

Quantity consumed (demanded) of each food product is estimated as a function of household income, product prices, consumer taxes and fixed shifters of the consumption function. Households are grouped into different income classes (for example, poor, middle and rich), and one equation with income as the dependent variable, and off-farm income, farm profits and remittances as explanatory variables, is estimated for each class. With appropriate weighting, total national demand for each food product can be calculated. The demand function for wheat is written as:

$$dq_w^d/q_w^d = e'_{ww}(dp_w/p_w) + e'_{wr}(dp_r/p_r) + e'_{wG}(dG/G) + e'_{wt}(dt/t) + e'_{wy}(dy/y)$$

where G is a fixed household demographic factor affecting tastes (perhaps location of the household within Egypt), t denotes a fixed tax or income transfer, y is income and e'_{wy} is the income elasticity of demand for wheat. To the extent that they directly affect prices, changes in food tariffs or subsidies can easily be simulated using an equation such as this one. Of course, to the extent that other goods compete for consumers' limited income, price effects and elasticities of complements and substitutes also need to be introduced into this equation. Household income, which is endogenous in this model, is a function of profits (revenues from production minus

costs), off-farm income, and remittances. An appropriate equation for change in income (dy/y) is also added to the multi-market model.

4. *Equilibrium conditions*

One equilibrium equation exists for each product and for each factor of production; quantity supplied plus net imports (*NE*) of the product or factor are equal to quantity demanded. For example, in the case of wheat:

$$dq_{ws}/dq_{ws} + dNE_w/dNE_w = dq_{wd}/dq_{wd}$$

For internationally traded products and factors, prices are equal to world market prices and net imports and quantities are endogenous. For non-tradable products, net imports are fixed exogenously, and prices as well as quantities of products and factors demanded are endogenous. The balance of trade is equal to the net imports of each product and factor of production.

5. *Government revenue*

Government revenue is a function of consumer tax rates (including subsidies), nominal rates of protection, net exports, prices, quantities demanded and exogenous government revenues. Once this equation has been derived, a log-linear version similar to the above equations is added to the multi-market model.

A more abstract version of the above model is presented in Sadoulet and de Janvry, chapter 11, pp. 309-311, along with illustrations of how multi-market models have been used in the past. Although the multi-market system of equations could be solved numerically using software such as GAMS (the General Algebraic Modeling System) if complete functional forms for each of the original production and consumption equations are available, we propose using a log-linearization and matrix algebra. This involves collecting all of the endogenous and exogenous variables in the system, and solving for the endogenous variables as a function of the exogenous variables (policy changes) using matrix inversion. While this approach limits the size of the changes in individual policy variables that can be simulated (say, to changes in the order of magnitude of 10-25%), it has the advantage that no assumptions have to be made about the specific functional form underlying each equation, and the model can be solved using a spreadsheet program.

2. USING A CGE MODEL TO ATTRIBUTE APRP EFFECTS

A number of reforms are presently underway in Egypt in various sectors of the economy. Many of these reforms, such as those in the banking sector, will have significant impacts on the entire economy, and specifically on individual sectors such as agriculture. This raises the question of how APRP impacts on key policy variables can be separated from the impact of non-APRP reforms in other sectors. More specifically, the challenge for policy analysis is to attribute changes in consumer and producer welfare over time to APRP as opposed to reforms in other sectors.

The only practical way of sorting out--or attributing--the effect of a particular policy when there are multiple, competing policies which cut across different economic sectors is through the use of a CGE model.

Computable General Equilibrium (CGE) models are economy-wide models characterized by simultaneous solution of a nation's production, consumption and trade activities under alternative policy specifications. Most CGE models have focused on international trade issues, and have been used in a number of developing countries to study economic impacts of structural adjustment policies. Typically they are expanded from Social Accounting Matrix (SAM) models, which are multi-sector models of a national economy. SAM models are linear, fixed coefficient, and non-optimizing and do not incorporate product demand functions, and hence do not find final general equilibrium solutions.

Several generations of SAM models and of CGE models based on them have been developed and applied in Egypt. An IFPRI team has developed a CGE model for purposes of studying land and water policy. The Egyptian Land-Water (LW-CGE) model[1] combines a simulation model of the non-agricultural sectors with an optimizing programming model of land and water use in agriculture. Unusual among this class of models, the Egyptian LW-CGE model disaggregates agriculture into several subsectors and emphasizes land and irrigation water resource issues.

Agricultural technology is represented in the model by a simplified activity analysis and programming approach with inequality constraints. Eleven sectors--five non-agricultural sectors and six agricultural sectors--comprise the model. The agricultural sectors are cotton, rice, grains, sugar, fruits and vegetable and other, each using land, water, capital, labor and intermediate inputs. Oil, industry, services, electricity, and construction are the non-agricultural sectors, each using capital, labor and intermediate inputs. The agricultural sector is quite simplified, assuming homogeneous land with a fixed supply of water which can be freely allocated among different crops (and among different regions). Livestock is not explicitly considered. Also, there is no regional differentiation of agriculture, no representation of multiple cropping or differentiation of land into varying qualities. Thus, the LW-CGE differs from the EASM in its incorporation of more detail in the non-agricultural economy than the latter and less detail on the agricultural sector. Two versions of the model were developed: “simplified" and "expanded" versions. The expanded model includes more detail on labor supply, the form of taxation, government demand, aggregate investment and international trade. In addition, a modified version of this CGE model was developed by S. Sedik et al. (c. 1997) to examine the effects of a tariff reduction on Egypt's economy.

Bartsch (ca.1996) recently reported on another CGE study of the Egyptian economy, this one focusing on the issue of income distribution impacts of alternative cotton policy. The data base is a SAM based on Lofgren (1994), which in turn is built around a model developed by the Egyptian Ministry of Planning using data for 1991/92. Bartsch's objective was to assess the

[1]See Sherman Robinson and Clemen Gehlhar. 1995. "Land, Water and Agriculture in Egypt: the Economywide Impact of Policy Reform" TMD Discussion Paper No. 1, Mimeo. International Food Policy Research Institute, Washington DC, January, 1995

income distribution impacts of government policy interventions. His primary contribution was to use expenditure data to disaggregate the household account into comprehensive income and expenditure accounts for seven socio-economic groups, each with distinct factor incomes and savings behavior. Bartsch also expanded the agricultural sector into more detail, (including three cotton production activities). He further expanded the textile sector into nine yarn spinning and nine weaving sectors according to product quality. The model was used to experiment on how different cotton subsector policies affect income of the various household income categories.

The following table shows how each of the sectoral policies identified in the SPR Document, "Comparative Presentation of the IMF and USAID Reform Program" (Ministry of International Cooperation, c.1997), could be incorporated for simulation purposes into a Computable General Equilibrium (CGE) model. The basic procedure is initially to calibrate the CGE model by reproducing existing economic conditions in 1997. One simulation would incorporate the effects of APRP in the model--as reflected in changes in agricultural input and output prices as well as changes in technological coefficients at the production and marketing levels--to the extent that these are known and can be attributed to APRP, along with each of the sector-specific policy changes identified below. Another simulation would consist of including only the sector-specific policies (without APRP changes), so that the net effect of agricultural reforms can be isolated from the general macroeconomic policy effects.

Sector Impact	**CGE Model Simulation**
I. Public Enterprise Companies' Privatization	increase in GOE Revenues
	change in technical coefficients
II. Use of Privatization Proceeds	same as above
III. Transition to Market Economy	tbd (to be determined)
IV. Trade Liberalization	reduction in tariff rates
V. Removing Restrictions on Imports/Exports	effect on prices of removing quotas (cotton)
VI. Increase Private Sector Imports	elasticities of substitution
VII. Exchange Policy and System	(recent) exchange rate appreciation
VIII. Energy Prices	higher energy prices
IX. Protection of Environment	no immediate effect in CGE (other than via VIII)
X. Financial Sector Reform	change in technical coefficients in banking sector
	change in social insurance system
XI. Deregulation	decontrolled housing market (effect on rents)
	change in labor law
	impact of changing incentives
XII. Statistical Issues	none expected other than improved SAM data
XIII. Fiscal Policy	GOE spending/GDP
	fiscal deficit (dissaving)
	technical coefficient for government sector employment
XIV. Structural Fiscal Reforms	
1. Reform of Revenue System	change from general sales tax to value-added tax
	technical change in public sector
	corporate tax reform
2. Expenditure Reform	reduction in civil service employment
XV. Monetary Policy	reduced nominal interest rates (cost of capital)
XVI. External Policies	change in balance of payments position
XVII. Medium-Term Macroeconomic Framework and Outlook	not applicable or covered above

CGE models could in principle be used to analyze economy-wide effects of APRP interventions. An adaptation and updating of Bartsch's model, which focuses on income distribution in the cotton sector, would address issues of particular interest to APRP. However, their heavy demands for data and analytic skills may limit their usefulness to MVE. We do not recommend including a CGE modeling effort for inclusion in MVE's impact assessment program.

3.FORMULA FOR DECOMPOSING NOMINAL PROTECTION COEFFICIENTS

The following discussion and formulae are based on Chapter 7 in Sadoulet and de Janvry (1995), who review the work of Krueger, Schiff and Valdes (1988). To decompose the protection effect into agricultural and general macroeconomic policy origins, MVE can use a modified formula for the nominal protection rate. In particular, by using the equilibrium or shadow exchange rate (e^*) in place of the actual exchange rate in calculating the border price ($p^{b*}=e^*p^{\$}$), one obtains the *real* rate of protection for product *i*: RRP_i. Krueger et al. show that this rate can be decomposed into direct and indirect parts as follows:

$$RRP_i = [(p/p^n - p^b/p^n)/(p^{b*}p^{n*})] + [(p/p^n)/(p^{b*}p^{n*}) - 1],$$

where p^n is an index of prices of nonagricultural goods, p^{n*} is the same index measured using border prices at the equilibrium (shadow) exchange rate, and the other variables were defined earlier. The term in the first pair of square brackets shows the effect of trade policies directly associated with product *i*. The term in the second pair of square brackets measures distortions associated with protection of all industries in Egypt, as reflected in a distortion of the exchange rate from its equilibrium. This can be seen by writing the term in the second square bracket as $(e/e^*)(p^{n*}/p^n)$. The decomposition method proposed by Krueger et al. requires the use of a price index for nonagricultural goods. Such an index is not required for the second decomposition method, which is discussed next.

More recently, Herrmann (1997) has proposed a procedure for decomposing the net nominal protection coefficient into components related to agricultural policy on the one hand, and general macroeconomic conditions, as related to exchange rate distortions, on the other. Again, this allows MVE to separate the impacts of agricultural sector reforms from reforms in the rest of the economy in a relatively simple but robust manner. In addition, Herrmann presents a formula for attributing the effect of agricultural policies on producer price stability over time, and also discusses how the effect of agricultural as opposed to general macroeconomic policies on the growth of producer prices over time can be estimated. All of the data needed for these calculations are available from Dr. Omran's dissertation, but these data will have to be updated for a post-reform assessment. More specifically, the necessary data include farm gate prices, world price equivalents at the farm level (both are reported in Table IV-4, p. 136, with annual data for 1970-1996), and the actual and shadow (equilibrium) exchange rates, which are reported in Table III-8 on p. 94 and cover the years 1975-1996.

Herrmann (1997, pp. 205-6) presents the following equations for decomposing the total net nominal rate of protection (N_t) for a particular agricultural product into agricultural and non-agricultural policy sources:

$$N_t = 100(p\text{-}p_w e^*)/p_w e^*$$

where p is the farm gate (producer) price of the product in Egyptian pounds, p_w is the international market price of the product measured in U.S. dollars, and e^* (in LE/$) is the equilibrium or shadow exchange rate, which converts the dollar price into Egyptian pounds. The portion of total protection caused by domestic agricultural policy intervention is measured using:

$$N_a = 100(p\text{-}p_w e)/p_w e^*,$$

where e is the actual exchange rate. The distortion caused by general macroeconomic policies in Egypt is:

$$N_m = 100(e\text{-}e^*)/e^* = 100(p_w e\text{-}p_w e^*)/p_w e^*.$$

Adding together N_a and N_m yields N_t, since the terms $+p_w e$ and $-p_w e$ in the numerators of N_a and N_m cancel each other out. Consequently, this presents a relatively simple but useful calculation which MVE can use to assess the effects of agricultural as opposed to general economic reforms in Egypt on the net nominal protection coefficient for key crops over time.

To assess the effect of agricultural policies on producer price (in)stability relative to world price stability over time, Herrmann proposes the following calculation (p. 206):

$$S = 100[(\text{V ln } p_i)^{0.5} - (\text{V ln } p_w)^{0.5}]/[(\text{V ln } p_w)^{0.5}],$$

where V is the variance, ln the natural logarithm and p_i the domestic price of the product measured in dollar terms. This number can be calculated by MVE for the pre-reform period as well as for the period of years in which APRP has been in effect (i.e., at the end of the project).

4. CALCULATIONS FOR THE SHIFT-SHARE ANALYSIS

National Growth Component [N]

This first component identifies the impact on the region of the change in total production nationally. In other words, it measures the potential change in total regional crop production, if the regional farm economy behaved exactly like the average of all of Egyptian agriculture:

$$N = \text{Sum}_i X_{ib} g_n,$$

where Sum_i is the summation operator, I indexes each crop, X_{ib} is the value of production of the ith crop in the pre-reform (base) year b and g_n is national average growth rate over all crop sectors between the pre- and post-reform years. The quantity N shows by how much the crop production of the Governorate would have grown if its crop production patterns were exactly like the nation's.

The total value of crops produced will grow more rapidly than the national average in some Governorates over time, and less rapidly in others. The next two calculations, for the industrial mix and competitive share components, identify two reasons why this is occurring.

Industrial Mix Component [M]

The industrial mix component shows by how much a Governorate's total crop production is growing as a function of the degree to which local crop production is specialized in rapidly or slowly growing crop sectors:

$$M = \text{Sum}_i X_{ib} (g_{ni} - g_n),$$

where g_{ni} is the national average growth rate of the production of the *i*th crop between the pre-reform (base) and post-reform year. A Governorate in which a large share of the crop production is allocated to crops growing rapidly at the national level will experience more rapid growth (i.e., $M > 0$) than a Governorate in which more resources are allocated to producing crops which are experiencing only slow growth.

Competitive Share Component [S]

The third component measures the degree to which a Governorate is bidding crop production activity away from other regions of Egypt because it is more competitive and efficient than those regions. Thus, this measures the local region's ability to capture an increasing share of a particular crop sector's growth:

$$S = \text{Sum}_i X_{ib} (g_{li} - g_{ni}),$$

where g_{li} is the Governorate's (local) growth rate for production of the *i*th crop between the pre-reform (base) and post-reform year. If $S > 0$, the Governorate increased crop production above the level due to national growth (measured with *N*) and its particular crop-production structure (measured with *M*), and this means the Governorate is more capable (efficient) in increasing crop production than is the rest of Egypt. In this manner the growth in crop production of each region (Governorate) in Egypt can be decomposed into three separate components using the equation: $R=N+M+S$. One limitation of this method is that it does not explain *why* changes occurred in *N*, *M* or *S*. However, with a relatively small effort it can shed light on some of the sub-national effects that are occurring under agricultural policy reforms.

More specifically, results of the shift-share analysis can be used to determine whether and how crops mixes are shifting as restrictions are removed from regional production in Egypt, subject to irrigation water constraints. Since the production of different crops was liberalized in different years, different base (pre-reform) years should be chosen, depending on which crop one is primarily interested in. Calculations starting with 1986 as the base will include effects attributable to APCP. Data needs include Governorate- (and preferably district-) level crop-specific production data for at least two points in time, such as before and after the agricultural reform. The value of production reflects area (land), yield and price effects. The necessary Governorate-level data are available from official annual publications of the Ministry of Agriculture and Land Reclamation.

5. ROLE OF GIS AND SPATIAL ECONOMICS

The following items have a high priority as potential tools for evaluating APRP. However, given data availability and MVE resources, it does not appear that these kinds of analyses are presently feasible. The GIS application should also be considered within the larger strategy of developing a timely market information system. In an ideal situation, local price data collected at points throughout Egypt would be fed into a central computer data base in the morning using GPS devices, tabulated and reported by noon of the same day. This would produce an instantaneous price reporting system that would be of use to all market system participants.

5.1 Potential GIS Applications Relevant to APRP

Geographic Information Systems (GIS) are digital data bases containing socioeconomic, geophysical, infrastructural and other forms of data, which have a spatial reference (usually a longitude and latitude value). Basic features may be points (markets, villages, cities, etc.), lines (irrigation canals, streets, highways, railroads, high voltage electricity lines) or areas (political districts, crop fields, mineral deposits, etc.). The purpose of such data bases is to highlight correlations that may not be obvious when only tabulated data are examined. Also, a GIS can highlight areas of a region or country satisfying a certain set of criteria. One example is siting a landfill, which may be located only on a certain class of soil, with a maximum slope, at a minimum distance from a residential area, and a maximum distance from transportation routes. GIS applications have also included the development of optimal transportation routes and networks. The following are examples of potential applications to APRP.

A. Irrigation management system (Water User Associations)--EPIQ
   design optimal routing/distribution system to reduce water problems facing end-users of the system while allowing for flushing of rice fields´ incorporate total dissolved solid (TDS) levels and water leakages
   track salt water intrusion levels in the Nile Delta
B. Spatial distribution of prices (IFPRI; CAPMAS)
   correlate with local production levels
   identify relevant local market areas for traders
C. Spatial distribution of agribusiness (1996/7 KOMPASS CD-Rom)
   business responses to market reforms (new locations)
   impact on price formation in local markets
   identify optimal location patterns of private agribusinesses
D. Spatial diffusion processes
   improved production technologies
   improved management practices (ATUT)
E. Summarize spatial impacts of APRP on variables such as production, consumption, income and prices at the level of districts or other political boundaries.

5.2 Potential Applications of Spatial Econometrics

In spatial econometric analysis, each unit of observation (district, market, individual household) has an associated spatial reference value, which is summarized in the form of a spatial weights matrix. This matrix may simply record which units are adjacent to one an-other--a contiguity matrix--or the inverse of the (Euclidean) distance between different units in kilometers--a spatial weights matrix in which the weights decline with distance. A basic principle behind this type of analysis is that "everything is related (in economic development), but things that are closer together in a spatial sense are more strongly related than are things that are further apart."

In econometric analyses, the efficiency of parameter estimates is increased by including the information contained in contiguous units. In addition, the coefficient estimate on the spatial weights matrix reveals the strength of the relationship between contiguous units, or units which are closer together. The following list shows potential spatial econometric applications.

A. Tests for spatial market integration (central markets vs. hinterlands).
B. Explain agricultural/economic growth in a district as a function of growth in surrounding districts as well as distance from major cities or urban center(s).
C. Estimate spatial diffusion models for new technologies, as a function of spatial processes.
D. Identify causality between new agribusiness locations and local production responses.

APPENDIX B
DETAILED DESCRIPTION OF RECENT AND PLANNED SURVEYS

1. IFPRI HOUSEHOLD AND COMMUNITY SURVEYS

1.1 Household-Level: The Egypt Integrated Household Survey (EIHS)

A nationally representative, single-round survey was conducted during a ten-week period in March-May 1997, covering 2,500 rural and urban households in 20 governorates. The 1986 Egyptian Census master sample frame from CAPMAS, which was updated in 1995, and a two-stage stratified selection procedure were used to select households for the study. The stratification variable consisted of five regions: Metropolitan, Upper rural and urban, and Lower rural and urban Egypt. Across all strata 125 Primary Sampling Units (PSUs) were randomly chosen from 296 urban and 196 rural PSUs using probabilities proportional to the population of each PSU. Within each PSU, 20 households were selected at random, along with five replacement households. Sampling was carried out by the Head of the Sampling Division at CAPMAS (Nagla Salim) under a consulting contract.

This two-stage sampling procedure results in larger standard errors for individual variables than would be obtained from a completely random sampling design, but has the advantage of reducing survey costs per primary sample unit while producing data and statistics that are more representative of the nation as a whole, given the sample size. The two-stage sampling method was accounted for in calculations of standard errors reported to date in FSR studies. Eight percent of the data was not usable for the preliminary analysis done to complete FSR reports submitted under tight deadlines. The final, cleaned data set will include 2,500 households.

The household survey instrument was based on a standard World Bank questionnaire format (from the LSMS or Living Standards Measurement Survey) used in a number of countries. Different questions were asked of male and female respondents using teams consisting of one male and female enumerator. Care was taken to accurately define a household unit "a group of people who normally live and eat their meals together" but no information was recorded on extended family or other intra-household relations.[1]

The original male household questionnaire included the following information:

- a roster of household members
- education and literacy status of each member
- information on parents
- primary and secondary employment activities and unemployment status
- type of dwelling, housing expenses, utilities and amenities in the home
- migration and remittances and transfers (income sent and received)
- meals purchased away from home
- non-food expenditures

[1] Family kinship ties across households, such as among brothers forming two separate consumption units, can affect food security strategies, ability to invest in equipment, risk attitudes, etc. The EIHS did include questions about credit, however, which can contribute to a better understanding of the extended family's contribution to food security.

- inventory of durable goods
- casual or temporary labor by household members, as well as salaried employment
- landholding
- production and crop income
- input expenditures
- miscellaneous revenue sources and expenditures
- farm assets owned
- general non-farm business characteristic, and non-farm income
- borrowing and outstanding loans, as well as credit rationing and lending
- other asset holdings and other income

Female respondents were asked about access to various facilities (public and private services); food expenses and home production; consumption by visitors; child morbidity; immunization; anthropometric measures (children and mother); maternity history including pre- and post-natal care; pre-school practices and child care; livestock ownership; and expenditures on subsidized foods (tamwin sugar and oil, baladi bread and wheat flour).

A pre-test of the survey instrument in over 20 households in November 1996 revealed that the original instrument was too long and complex. This led the team to separate the anthropometric measurements from the primary survey. Intensive training sessions were held over a two-week period using the refined survey instrument. Delays in survey implementation occurred because the beginning of the original survey period would have coincided with the month of Ramadan; because of the desire to ensure that the questionnaire was completely relevant to Egyptian households and the circumstances they face; and because an effort was made to match closely the questionnaire design to the plan for subsequent analysis.

The survey period extended from the first week in March to the third week in May 1997, with a one-week interruption due to a religious holiday. A majority of the 108 enumerators (98) were from MALR, and the remainder were from MOTS. CAPMAS provided an official letter of justification (support) to enumerators for their data collection activities, and supplied official identification cards which were also signed by the police authority in each community. The amount of time required for each survey administered in rural areas was 2-3 hours, compared with 1 hour in urban areas. Most of the questionnaires were filled out in a single visit (sitting).

Fifteen supervisors from the MALR directly monitored the work of enumerators, while IFPRI and CLFF (Central Laboratory for Food and Feed) staff conducted spot-checks of both enumerators and supervisors. Between 35 and 40 percent of all questionnaires were re-checked either by supervisors, research staff or both. This suggests a high degree of quality of the data collected. Data entry responsibilities were contracted out to a local firm the Demographic Household Survey (DHS) Group and the data entry error rate is estimated to be less than one percent, based on double-entry of 20% of the questionnaires.

The IFPRI household survey, administered over ten weeks, was stopped for one week during the Eid-al-Adha festival. Despite this, it appears as if some of the households (n=266) were interviewed after this holiday period and may have captured consumption during 1-3 days of holiday consumption patterns. This will not likely affect the demand elasticity estimates, because a) the specific households are known and can be controlled for using a dummy variable, and b)

what IFPRI captured for this group of households was very end of the holiday period consumption and is not likely to be significant. Note that a 24-hour food in-take recall study initially planned was not carried out.

The cost of fielding this survey and entering the data (but not counting questionnaire design time) was $160,000, which includes a charge of LE 30 per questionnaire paid to enumerators and LE 2 per household paid to CAPMAS for generating the sample frame. A second-round, shorter survey could be administered at about 60% of this amount, since enumerator and supervisor training needs would be lower.

1.2 Community Survey (Subcomponent of EIHS)

A separate questionnaire was administered in the 125 communities in which EIHS respondents reside. The primary purpose of this questionnaire is to identify determinants of poverty and to profile food subsidy institutions. Data collected from a number of different individuals or sources include: population characteristics and water supply and sewerage infrastructure; access to services, amenities and health facilities; informal financial markets [from the village councillor]; agricultural data on land, irrigation, crop cycles, wages paid to hired labor, rental rates for cattle and machinery, migration inside and outside the village [agricultural cooperative officer]; development programs in the form of micro-finance and other programs [local unit and specific institutions]; subsidized foods [tamween section, local unit] as well as markets and prices of consumer and agricultural producer goods [through spot checks in the market].

To estimate profit functions for generating supply elasticities it will be necessary to use input price data from this community-level questionnaire. This requires an implicit assumption that input prices do not vary seasonally, and that individual farmers paid prices corresponding to the average for the community. These do not seem particularly onerous considering the nature of Egypt's input markets at the present time. More serious problems arise from the fact that the study obtained only expenditure data for inputs, and the expenditures may not be broken down by crop. A catchall category allowed the enumerator to lump together for all crops expenditures on each input category if the farmer could not provide a breakdown. Until analysis of this data is further along it will not be possible to ascertain the extent of such grouping. If it was substantial, it probably means the IFPRI production data cannot be used to estimate production functions or supply elasticities.

2. WHEAT SUBSECTOR STUDIES (BY IFPRI)

IFPRI conducted a survey of 1,884 wheat and wheat flour merchants during the September 1996-February 1997 period in 18 governorates of Egypt. MALR obtained lists of registered wheat wholesalers and retailers in each governorate and sampled varying proportions of traders for an in-depth survey. The survey instrument covered trade characteristics; trading patterns; marketing costs; sources of market information; transportation and credit access; and trader responses to policy reforms as reflected in investments and expansion of trading.

2.1 Wheat Miller Survey

IFPRI conducted a survey of 530 wheat millers from June to mid-October 1997. The sample was essentially a census of known millers, covering the full range of mill sizes and technologies from village mills to modern sifted flour mills. IFPRI designed an elaborate questionnaire to capture highly detailed data on mill inputs and outputs, market outlets and prices paid and received, and profitability.

2.2 Daily Wheat Market Price Data Collection

Daily wheat and wheat flour wholesale and retail prices will be collected during June 1997-May 1988 in 18 markets by the team surveying the milling sector. The data will be used to analyze the impact of the reforms on the process of price formation. This activity is deemed necessary, because existing CAPMAS price collection efforts do not provide a continuous data series, and because gaps exist over space in governorate-level price data.

Coordination Issue: The possibility of adding other strategic crops such as rice and maize to this data collection effort should be explored (since the incremental cost is likely to be low). This would complement the market price collection/reporting system of MALR, supported by APRP/RDI and CSPP.

2.3 Survey of Wheat Producers

Data will be collected during May-June 1998 on wheat production costs and sales to complement the EIHS data by market zone and information on marketing activities. The sample size for, and location of, this activity are not yet determined. The objective of this activity is to analyze the response of wheat producers to market reforms. In addition, an attempt will be made to predict the effect of future agricultural policy changes on the farming sector. The number of producers sampled and their location will be determined in 1998.

3. MVE PRODUCER VERIFICATION SURVEY

In April-May 1997 MVE conducted a survey of 181 producers as part of the verification of the tranche I policy benchmarks. The timing of the survey followed cotton planting, thereby facilitating comparisons with last years crop. The time available to execute the survey was extremely limited (about three months) in relation to the number of benchmarks requiring verification (about seventy). Nine benchmarks in particular required verification at the producer level.

The MVE verification survey of producers used a combination of formal and informal interviewing techniques. Some of the questions were structured into a questionnaire while others arose during the interview, based on observations, responses, and relevant topics which the farmer wished to discuss. Analysts conducted the survey, rather than enumerators, to ensure good quality data and to allow for probing follow-up questions. The associate researchers posed the questions to the farmer in such a way as to: (I) give the farmer the chance to add more information about the related issues, (ii) give the interviewer an opportunity to develop additional questions and take notes as needed, and (iii) allow the interviewer to record the quantitative data in the questionnaire for each interviewed farmer. The questions covered cropping patterns, cotton

cultivation and pest control, cotton pricing and trading, wheat and rice trading, preferred sources of fertilizer, and water management issues.

The sampling procedure involved a multi-stage stratified cluster design. Eighteen Governorates which grow cotton were stratified by eight cotton growing zones. These eighteen governorates also included the six main rice producing governorates. One governorate was selected from each stratum resulting in eight governorates being selected at the first stage (Behira, Kafr El Seikh, Sharkia, Dakahlia, Fayoum, Beni Suef, Minya, Assuit). These included the four main rice producing governorates as well. Within each stratum governorates were selected with probability proportional to the area of cotton grown in the directorate.

At the second stage at least two districts were selected from each governorate selected at the first stage, again with probability proportional to cotton area. At the third stage villages within each district were stratified according to their distance from the main road (close, not-close) and one village was selected from each stratum, with equal probability. Finally, at the fourth stage farmers in each selected village were first grouped by size of holding and cotton production history over the previous two years. Six farmers were selected from each village. While the sample size was not large, it was representative and was large enough to determine how the policy reforms were affecting producers.

4. COTTON SUBSECTOR STUDIES

4.1 Cotton Sector Promotion Program (CSPP) Studies

4.1.1 Producer Survey of Seed Cotton Marketing Practices

Under the direction of Ronald Krenz, CSPP undertook a survey of 312 cotton growers in November-December 1996 that was focused on producer marketing practices. Detailed data were gathered on the following characteristics of cotton producing farms:

- area planted to cotton in the 1996 summer season, and crops grown in rotation during the 1995-96 winter season preceding cotton planting.
- producer cotton sales and prices received
- market outlet and timing of sales
- reasons for selling to PBDAC or alternative sales outlets
- producer price expectations prior to sale
- producer perceptions of the private sector and why it was not very active in seed cotton procurement following the 1996 harvest
- problems encountered in marketing
- cotton producer intentions to plant cotton in 1997

The sample was chosen from eight governorates**S**four each in Upper and Lower Egypt**S**with 97 growers in the former and 215 in the latter. The number of farms chosen per governorate was roughly in proportion to the cotton area cultivated in each governorate relative to the total area cultivated in all the sample governorates. The sample was stratified by area planted to cotton (< 2 feddans, 2-2.9 feddans, > 3 feddans), rather than by total farm size. The sample was not

stratified by variety, but the key LS and MLS varieties were covered. The Central Administration for Economics and Statistics (CAES) carried out the field work and entered the data. Three university professors were hired to supervise data collection.

4.1.2 Cost of Production Survey

As many of the CSPP interventions affect cotton producers, the CSPP agricultural economist designed and managed a producer survey in November-December 1996 that focused on producer costs and returns in collaboration with the Central Administration for Economics and Statistics (CAES) of MALR. CAES surveyed 400 cotton producers in two governorates, Dakhalia (270) and Beni-Suef (130). Farms were selected using a two-stage stratified random sample, where districts were the first stratum and cotton area cultivated was the second stratum (up to two feddans; 2.1-5.0 feddans; > 5.0 feddans).[1]

CSPP focuses its field interventions in two governorates. Dakhalia is a large cotton producing governorate in the Delta, where, in 1996 and 1997, farmers only grew Giza 86, a briskly selling LS variety. Beni-Suef is similar to Minia, Sohag and Qena governorates in Middle-Upper Egypt and produced Giza 80 in 1996 and 1997.

The CAES used its Sampling Section and field enumerators to collect highly detailed data on input use, including purchased and household labor, and output (returns) for seven cropping enterprises in Dakhalia and six in Beni-Suef (rice not covered): cotton, maize, wheat, rice, short and long berseem, fava beans. Data entry into crop enterprise-specific LOTUS spreadsheets was completed by May 1997; Tom Selzer is currently analyzing the data using EXCEL. He had to spend time cleaning the data after receiving the LOTUS files.

CSPP is planning to do a second cost of production survey with a smaller sample in the same two governorates where it is concentrating its activities. This survey needs to be designed soon and administered by the end of 1997. The sampling method and sample size have not been finalized. CSPP is open to MVE suggestions and possibly a limited number of well-conceived questions that MVE might propose to complement its producer mini-survey at the level of PBDAC seed cotton sales rings.

CSPP will need to do additional producer surveys in 1998-2001, assuming the project is extended three years, to monitor and evaluate the impact of CSPP technical innovations, such as mechanical soil preparation and sprinkler irrigation, on cotton production practices and producer incomes and welfare.

4.1.3 Gender Impact Analysis

[1] GTZ intended that CAES stratify the sample on the basis of farm size rather than cotton area cultivated (using the same breakdown). CAES did the actual stratification based upon cotton area cultivated, imparting a large farm bias to the sample. Tom Selzer is actually analyzing the data (doing breakdowns) using the originally desired farm size categories.

CSPP has prepared a report on gender impacts of CSPP interventions in the cotton subsector. This report is based on existing CSPP data (the producer survey disaggregates labor data by gender) and limited field visits to Dakhalia and Beni-Suef.

4.1.4 CSPP Support to CAES in Strengthening Collection of Seed Cotton Price Data

In collaboration with APRP/RDI, CSPP is providing technical and financial support to CAES to collect price data at PBDAC sales rings for the 1997-98 seed cotton marketing season. CSPP is providing support to CAES in the two governorates of Dakhalia and Beni-Suef; RDI is supporting price data collection in rings in nine other governorates. This effort is described below.

4.2 MALR Survey of Prices at Cotton Marketing Rings

At the beginning of the cotton marketing season of 1997/98, the GOE announced the framework of the cotton market for the new season, which implies that the private sector will be able to participate with cooperatives and public sector companies in cotton trading without any special constraints or restrictions. The GOE also announced earlier the floor prices of seed cotton, which were higher than the international market prices. Different alternatives were studied in order to compensate the cotton buyers for the difference between the international market and the announced floor price, and the deficiency payment system was chosen. Indicative prices are announced by ALCOTEXA on a weekly basis.

For assisting the GOE to apply the deficiency payment system, and for the purpose of market transparency, a cotton marketing information system has to be established to monitor market performance, and give the policy makers the potential to adjust to market conditions immediately.

It was assumed that the actual prices received by farmers may vary between different traders and locations for the same variety and the same grade depending on the bargaining power of both farmers and traders. Therefore, the pilot project should cover most of the cotton varieties (or all if possible) to test these hypotheses of types of traders and location effects. Hence, the RDI unit agreed with the Central Administration for Agricultural Economics to expand this pilot system to cover eleven (instead of two) of the main cotton producing governorates.

The participation of the RDI unit in this pilot project will enable the APRP to have access to raw data of cotton marketing, develop further the proposed cotton marketing information system, and carrying out further policy analysis studies and research.

4.2.1 Information and Data Collection

Key data collected includes:

- prices received by farmers for each variety in all of the selected governorates on a daily basis.
- deficiency payments paid by CATGO for each variety to different dealers and traders on a weekly basis.
- quantity delivered to each gin within the surveyed governorate on a weekly basis.

This activity began on September 1, 1997 and is expected to end by March 30, 1998. The Central Administration for Agricultural Economics will be the implementing agency through its offices in all governorates and under the supervision of the assigned experts of the RDI unit.

The cotton marketing information system activity has a team of enumerators, supervisors, data verification experts and data entry operators, data analysis and reporting staff. The RDI experts will assist in the preparation of different types of questionnaires, sample selection, on job training for the survey staff, and providing the analysis and interpretation of the results. According to data available regarding cotton varieties area allocation, a team of 10 enumerators, and 4 supervisors are conducting this field work. They are selected from the governorates' employees. Data entry and verification will be done by three operators and a supervisor from the information administration.

4.2.2 Questionnaire Design

The design of data collection sheet depends on the purpose of the system and needs of the users of such system. The stakeholders of the proposed system are mainly:

- cotton farmers, through monitoring the market prices of each marketing channel.
- the MALR, which aims to verify that producers receive the floor price for their cotton
- the MTS, which aims to monitor the deficiency payment system, as well as the participation of both private traders and cooperatives.
- private traders, cooperatives, brokers, and public sector trading companies, who will deal in marketing, and want to have access to all information regarding market performance.

A simple data sheet was designed to satisfy the objectives of different stakeholders and it was pre-coded.

4.2.3 Sampling and Survey Implementation

As mentioned above, Dakahlia and Beni-Suef governorates will be supervised by the GTZ and the remaining nine governorates will be supervised by the RDI Unit. It should be mentioned that each one of the selected governorates is selected to represent one variety, except for Beheira, which represents two varieties, G70 and G76, since they are concentrated in this governorate. In each of the selected governorates the district which cultivates the largest area of cotton is selected to represent the governorate. Three villages are selected randomly from each of the selected districts.

Data are collected from these villages during three specific days of the week (one specific day for each village). Every enumerator will collect from each village every week one sheet that includes 10 observations (transactions) representing different types of buyers, i.e. private traders, cooperatives, and public sector trading companies. These observations represent transactions that have taken place within the last week. Data sheets will be faxed to the central administration of agricultural economics daily. Verification and data entry will take place every day, the data will be tabulated and analyzed by the end of each week, and a market report will be available every Sunday.

4.2.4 Expected Findings

The weekly reports will be made available to MALR, MTS, cooperatives, public sector trading companies, and cotton private traders. The RDI unit hopes to publish these reports in the newspapers in the near future.

4.2.5 Survey Budget

The budget assigned to this activity by the RDI is 25,000 LE. This budget covers all of the monthly per diem and transportation allowance of the enumerators and field supervisors, as well as costs of data editing, entry and tabulation (operators and supervisors).

4.3 MVE Sales Rings Mini-Survey (Tranche II)

Many policy benchmarks in Tranches I and II are related to the cotton marketing and pricing. Seed cotton sales take place in sales rings managed by PBDAC. MVE elected to monitor these sales at about 50 rings. The cotton sales ring was chosen to be the pre-sampling unit, and questionnaires were designed to survey different groups at the sales rings (farmers, private traders, public sector companies' representatives, and PBDAC and CATGO representatives in the marketing rings).

A multiple frame was used to draw the sample. Clustering and stratification were conducted in order to select the appropriate sample. Stratification was conducted in three dimensions to reflect the location effect (Upper and Lower Egypt governorates), cotton varieties, and marketing rings of both the public and the private sector.

The sales rings mini-survey is based on a set of closed questions and administered through the above sampling technique. The survey is applied to about 50 marketing rings and consists of four separate questionnaires administered to approximately 150 cotton producers (at least three per ring), 50 PBDAC managers, 50 buying company supervisors, and 50 CATGO representatives (i.e. one of each respondent type per ring). The survey started in mid-October, and MVE anticipates that data entry and analysis will be completed by the end of 1997.

Farmers will be asked to report cotton area cultivated, output, sales and prices received (both in the ring and outside the ring), grade classification, timing of payment, and how much (and when) they pay for pest control services (where a subsidy is being phased out). Cotton traders, both public and private, will be queried about varieties, volumes, grades and prices of seed cotton purchased, ex-sales ring disposal of the seed cotton (sold, shipped to gins), and problems encountered. PBDAC representatives will give an overview of the sales ring under their supervision and asked about cotton sales volumes and prices, grades, and deficiency payments as a cross-check on what producers and traders report. Finally, CATGO graders, if present at the rings, will be asked about grading practices and the grades into which seed cotton at particular rings falls.

This survey of sales rings will be an important input into ongoing monitoring and verification of cotton subsector activities. It is not designed for impact assessment as such, but the survey will

obtain useful information about producer sales, seed cotton prices and grades, and the operations of the rings.

4.4 RDI Cotton Subsector Studies

4.4.1 Partial Equilibrium Model

RDI developed a partial equilibrium market and trade model to capture the effects of maintaining a seed cotton support price above international lint equivalent prices, while setting lint cotton minimum export prices and into-spinning mill prices in relation to world prices. Hence, the three key prices are set exogenously. Key variables in the model include prices, lint cotton exports, domestic utilization of lint (by spinning mills), carryover, and government expenditures (to maintain a high support price). The model is not designed to answer questions regarding the distribution of benefits among producers, domestic consumers (of textile products), foreign spinners and consumers, domestic spinners, and domestic traders and exporters.

4.4.2 Cotton Situation and Outlook

RDI also tracks international prices for US pima grade 3 (available through *Cotton Outlook*), domestic seed cotton prices for all Egyptian cotton varieties (generated by the Central Administration for Economics and Statistics of MALR, and export prices for export varieties of ELS and LS lint cotton (available from ALCOTEXA). RDI has begun to produce an Egyptian cotton situation and outlook monthly report. These data can be used to track changes in domestic and international prices (and changes in cotton producer income), as well as changes in Egypt's export volume and value over time (broken down by public vs. private exporters). Export market shares can be calculated using a broad breakdown of public vs. private, or by using four or eight firm concentration ratios. The volume, value and prices of domestic lint cotton going to local spinning mills can also be monitored, as can lint cotton stocks or carryover from one marketing year to the next.

4.4.3 Cotton Subsector Map

RDI has produced a cotton subsector map that shows numbers of participants (farms/firms) at each stage of the subsector, employment and throughput or output flows. This subsector map should be regarded as illustrative rather than definitive for some stages of the subsector, particularly private spinning, weaving, dyeing and finishing. It is a useful point of departure for tracking relative changes in public and private investment, employment and output in the cotton/textile subsector.

4.4.4 Financial Performance of Public Spinning and Weaving Companies

RDI has begun to work closely with public sector spinning and weaving companies in two of three holding companies. An initial study (M. Ibrahim et al.) reports basic firm-level (affiliated company) indicators of financial performance, including assets, inventory values, domestic and foreign sales revenue, and net profitability/losses. The data are not highly detailed or disaggregated, but they again serve as a useful point of departure for further monitoring of the financial performance of selected public sector textile companies. In-depth case studies will be required to achieve more disaggregated measures of economic and financial performance. Companies that RDI is attempting to restructure prior to privatization could provide useful case study material for MVE of before/after performance.[1]

There are no available data on private sector spinning and weaving firm performance. Although there is an Egyptian Textile Manufacturer's Federation, it does not collect information from its members on firm size, assets, employment, and financial performance. Other than by conducting case studies with a small sample of cooperative informants, it will be impossible to generate estimates of private sector investment and performance in the textile industry. CAPMAS supposedly collects firm cost, output and sales data, but these data are reported to be very partial, way out of date and unreliable.

4.4.5 Ex Ante Assessment of the Impact of Removing Barriers on Imports of Cotton Yarn

RDI has also begun to examine possible impacts of lowering and removing the high tariff of 30% on imported cotton yarn on the potential competitiveness and magnitude of yarn imports, supplies of LS/ELS cotton lint to domestic spinning mills, and LS/ELS lint cotton exports. The initial report, which pulls together a remarkable amount of information, is a good statement of the issues, an excellent compilation of relevant data, partial in its analysis, but nevertheless very useful.

Yet as the tariff is lowered from 30% to 10% or less, the impact on the structure and performance of the domestic cotton spinning and weaving industries needs to be tracked. Importing cheaper foreign cotton yarn, spun from short and medium staple cotton lint, would

[1] RDI is building upon initial studies done for the Cotton and International Trade Holding Company by a Dutch textile consulting firm for the Social Development Fund in late 1995 and early 1996. (See list of cotton subsector references).

affect the production costs, employment and profitability of domestic weavers. Facing stiff competition, many spinners, particularly public ones, could face bankruptcy without significant investment in new equipment and financial restructuring. The cross-sectoral and cross-industry impacts of lowering the cotton yarn tariff will be complex and worthy of careful monitoring and assessment.

4.4.6 Optimum Allocation of Investment and Resources in the Textile Industry

As part of its analytic agenda, RDI's Privatization Unit would like to monitor and evaluate changes in the organization, ownership, management and performance of the textile industry. As prices and markets are liberalized, and as tariffs on imports of cotton yarn are lowered, how will existing resources in the textile industry be reallocated (or scrapped), and where will most new investment be targeted in the cotton/textile subsector? In addition, will all the public sector companies in the cotton subsector and textile industry eventually be privatized? What will be the impact of ownership changes on labor? As RDI's analytic agenda is finalized, these and other impact assessment questions will be better formulated and could well contribute to MVE's ability to understand structural and performance changes in a critical agro-industry in Egypt.

5. RICE STUDIES

5.1 Univ. of Arkansas Study and Follow-Up

A team of University of Arkansas analysts, led by Eric Wailes, and Egyptian consultants carried out an in-depth study of the rice subsector in 1994, which used data from 1993-94 APCP verification surveys and MALR. The 1994 study, published in March 1995, was updated in 1995-96 by Ragaa et al. (1996).

The 1994 study[1] was a detailed investigation of rice prices, production and processing costs, marketing margins, exports, and rice consumption. It used data from the 1993-94 surveys of rice producers (200), private rice dealers (157), and various types of mills (122 public, private commercial and private village mills), as well as available secondary data from MALR, CAPMAS and MPWWR. The Arkansas team developed an econometric model for the Egyptian rice economy whose major components are a supply sector, a demand sector, and price linkage equations. The model uses data from the 1970-1992 period. Data on harvested area, yield, total consumption, and export are provided by the USDA PS&D, while price data were obtained from the MALR. The Arkansas team did a baseline simulation (without GATT) and a with GATT projection of Egyptian and world rice markets, including Egypt's rice production, consumption, price and export levels. Both the baseline and GATT projections show rice area cultivated declining from 1993 to 1994 and beyond. The counter-factual reality was that area has steadily expanded, reaching an estimated 1.5 million feddans in 1997, nearly three times the projected area of 530,000 feddans for 1994-2003 in the baseline and with GATT runs.

[1] The Arkansas team and local consultants collected data and prepared a preliminary draft over the February to July 1994 period.

The 1996 study, which reported the results of several June-August 1995 formal surveys of rice producers, dealers and millers, included the following subsector participants and sample sizes.

Subsector Participant	Sample Size	Aggregate Output or Throughput (mt)
Farmers	200	1,121
Dealers (paddy & milled rice)	120	6,790
Millers, public sector	10	207,900
Millers, "traditional" private	10	6,585
Millers, small village	65	36,493
Millers, new commercial	10	8,530
Millers, total	*95*	*259,508*
Exporters	4	17,400

Source: M. Ragaa El Amir et al. 1996. *Analysis of Egypt's Rice Marketing System*, Datex Inc. Prepared for USAID/Cairo.

Note: The milled throughput of the surveyed rice millers represented less than ten percent of estimated national milled rice output in 1995.

5.2 MVE Rice Subsector Rapid Appraisal

As part of Tranche I Verification, MVE undertook a rapid assessment to verify several rice subsector liberalization and privatization benchmarks. Two consultants conducted in-depth informal interviews with GOE officials, public and private rice millers, and knowledgeable observers and analysts in April-May 1997. MVE obtained limited time-series data on rice exports, as well as a percentage breakdown of public and private export shares over the last 5-6 years. Some paddy price and export price data were collected from private sector exporters for the 1996-97 marketing season. Obtaining time-series data from CAPMAS on rice wholesale and retail prices was not possible (although these data are available with a considerable lag from published bulletins of wholesale and retail prices for a broad range of food products).

5.3 RDI Rice Subsector Studies

5.3.1 Rice Subsector Map

RDI consultants have gathered data to produce a preliminary rice subsector map. Various map overlays show physical product flows, numbers of firms and employment at each stage, and prices and costs at different stages of the subsector. The estimates are rough and based upon limited data and a number of assumptions about milling out-turn and throughput. The estimates of private sector rice processing firms are surprisingly high, suggesting that considerable excess capacity has emerged in the industry. As the rice tariff is progressively lowered and import regulations clarified, commercial imports of milled rice will expand. This will lead to a decline in domestic paddy production (and milling), putting pressure on the less efficient mills (particularly public sector ones), and leading to closure of the least efficient millers.

5.3.2 Ex-Ante Rice Mill Privatization Study

RDI is working with the Wheat and Rice Flour Mills Holding Company to prepare one of its affiliated rice milling companies for privatization. Detailed technical and financial data, collected during the Wailes et al. study of 1993-94 for different types of mills using different technology, are being updated for this one public rice milling company to allow for financial and economic analysis of profitability under alternative assumptions about capacity and throughput. The privatization of any public sector rice mills should be closely monitored; there is some skepticism regarding privatization possibilities for most of these mills. While public sector mills produce a high quality, export grade output, they have high operating costs and cannot compete with either private commercial or village level mills, both of which have proliferated during the past 4-5 years.

5.4 Rice Price Data

Through its support to the MALR/CAES, RDI will facilitate collection, processing and analysis of rice price data. The DEPRA Project in the MTS hopes to build a price data base for several key agricultural commodities,[1] including rice, using CAPMAS price series for wholesale and consumer prices in selected governorates and major metropolitan markets, particularly Cairo and Alexandria.

6. HORTICULTURAL SUBSECTOR STUDIES: ATUT

ATUT began in October 1995 and will be completed by September 2001. It is focused on promoting improved and increased production of horticultural products, better post-harvest handling, more timely and private sector-usable market information, and expanded exports of produce to regional (Middle Eastern) and European markets. As part of a strategic planning

[1] DEPRA is interested in covering the following commodities: wheat, maize, rice, cotton, poultry and possibly berseem.

exercise, ATUT classified promising horticultural crops into three categories, with grapes, strawberries, mangoes and melons falling into the highest potential export products. ATUT is monitoring and evaluating progress in project implementation and its effect on growers, exporters and wholesalers.

6.1 Horticultural Producer Surveys

A baseline survey of 152 growers was conducted in the summer of 1997, with 67 farms in new lands (Nobareya) and 82 farms in old lands (Ismailia, Qalyobia and Sharkeya). ATUT selected the sample purposively to capture farms which produce the four priority horticultural crops (noted above). These farms, specialized in horticultural production, are on average larger compared to other farms in their areas. The sample farms are broken down by size of holding into three categories for the new lands and old lands.[1] Farms in the new lands produce horticultural crops on approximately 80% of their holdings on average, while farms in the old lands are a little more diversified, growing horticultural products on 65-76% of their cultivated area and field crops and "other crops" on the remaining area.

While these farms cannot be said to be representative of Egyptian farms in general, they represent quite well the types of farms, in areas specialized in horticultural production, that are oriented to export horticulture. Given the GOE's export promotion thrust, it is important to track a series of production, sales and export variables for ATUT and SO1. While APRP will not emphasize horticultural production and export data gathering, it will be able to use the indicators and analytical findings of the ATUT M&E surveys. ATUT's baseline survey of growers will be followed by midterm and final impact assessment surveys covering crop mix, area cultivated by crop, input use and expenditure, output, prices, export sales, and participation in ATUT activities and adoption of improved technologies promoted by the project.[2] (It is not clear if sales of produce for the domestic market will be tracked). ATUT will identify new "contact" farmers (beneficiaries) as the project unfolds and after the baseline survey was completed; these farms will also be monitored and evaluated.

6.2 Horticultural Wholesaler Survey

ATUT has also done a horticultural wholesaler survey (15 grape wholesalers) in the three major wholesale markets of Egypt, which are Alaboor (near Cairo), Al-Mansoura (in the mid-Delta region), and Al-Nuzha (in Alexandria).

6.3 Analysis of Secondary Horticultural Export Data

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[1] For new lands, the holding size categories are as follows: small (less than 15 feddans), medium (15-50 feddans), and large (> 50 feddans). For the old lands, the categories are small (< 5 feddans), medium (5-25 feddans), and large (> 25 feddans) farms.

[2] The draft *Baseline Study and First Annual Monitoring Report* includes crop enterprise budgets cantaloupes, mangoes, strawberries, and three grape variety/technology enterprise mixes. Input data include cubic water applied per feddan and detailed labor data broken down by operation and worker type (man, woman, child).

ATUT also plans to gather and analyze national (and regional?) level secondary data on horticultural production and exports. The Plant Quarantine Department of MALR is the source of horticultural export data, as this agency inspects all produce prior to export. Lacking the resources to track exports systematically, the Quarantine Department provides export inspection sheets daily to ATUT's MIS for computerized entry and analysis. ATUT's periodic monitoring reports summarize these data in considerable detail (by crop, variety, day/week/month, export destination, etc.). The ATUT Project has quantitative export targets (e.g. increase exports of the four highest priority commodities by 10%).

ATUT's Marketing and Technology Information Unit (MTI) also prepares commodity-specific data reports. One on fresh mangoes in March 1997 reports on world production, Egyptian area, output and value of production (for 1993-94 and 1994-95), costs of production (per feddan in the New Lands and the Nile River Valley for 1995-96), Egyptian mango exports (1993 to 1995) by month and destination, EUROSTAT import data by supplier for each major EU market (1995-96), and mango wholesale prices (low, high, mean) in major EU terminal markets for 1993 to early 1997. ATUT has prepared data reports on the other priority commodities and plans to release quarterly updates.

6.4 Gender Survey

ATUT undertook a separate survey of horticultural producers in April-May 1997 to examine gender issues. 300 farms were sampled (150 participating in the ATUT Project and 150 not participating) and stratified by size (large, medium, small farms). AERI enumerators actually collected the data, under the supervision of an outside contractor (Dr. Sawsan El-Messiri of International Development Consulting Services). The survey focused largely on women's employment in horticultural production and the impact of new technology introduction on women's labor. Periodic updates are planned. Note that this particular survey generated additional data on farm size, crop mix, horticultural production and sales, which can be compared with the findings of the baseline survey.

7. THE NEW LANDS DEVELOPMENT STUDY

The New Lands Development Study (NLDS) was carried out in late 1993 under the New Initiatives component of the National Agricultural Research Project (NARP), supported by USAID and the MALR. The study's primary objective was to evaluate alternative new land development approaches and determine the levels of return to alternative enterprises and submit recommendations on future investment priorities.

The New Lands Development Study relied on four types of primary data collection in order to collect data on land use, cropping pattern, yields, farming practices, marketing channels and levels of infrastructure. These primary collection sources were:

1. Small Farmer Questionnaire
2. Rapid Rural Reconnaissance Survey
3. Agro-industrial Farm Survey
4. Land Use Change Analysis

Several selection criteria were applied such as type of soil, water source and quantity, method of irrigation, type of farmers, and the year the land was developed. Seven sites were selected according to time and budget constraints. The survey sites were: West Newbury (Sugar Beet), West Newbury (Busman I), Menoufia (El Khatatba), Kafr El Sheikh (El Hamomoul), Ismalia (Maneif), Fayoum (Tamia), and the New Valley (Kharga, Dakhla, and Farafra). An additional site was also chosen in Sinai (Rafah and Shiekh Zoid). The selected sample size was 546 farmers, where 521 questionnaires were completed in seven selected sites of the new land areas, and 25 questionnaires in Sinai.

The collected data were to serve two purposes: 1) obtain estimates of current levels of returns for various farm types under various conditions; and 2) provide estimates of potential rates of returns to existing alternatives.

The NLDS study contained the detailed results of the small farmer survey and its analysis. The study data base was provided by USAID and is available to the impact assessment team and MVE. The collected data of this survey were combined in a data base and can be used in the future as a baseline study, which can be updated in the future. There is a benchmark in Tranche II dealing with access to new lands; more benchmarks concerning the same issue are expected in the future.

8. ENVIRONMENTAL POLICY AND INSTITUTIONAL STRENGTHENING IQC (EPIQ)

A team of Egyptian and expatriate scientists is being assembled under the framework of the Environmental Policy and Institutional Strengthening Indefinite Quantities Contract (EPIQ) to assist MPWWR in technical analysis of water policy and institutional reform issues over the period July, 1997 to June, 2000. The EPIQ team moved into offices on the ninth floor, MPWWR building in Imbaba in October, 1997. Dr. Mohammed Nasr Allam was acting Chief of Party from early August through mid-December, 1997. Dr. Thomas Ley will be acting chief of party, pending arrival of the permanent COP, Dr. Jeffrey Fredericks in mid-January, 1998. The full expatriate team will include two water resource engineers, an irrigation engineer, a water resource economist, and a sociologist.

The *Work Plan for the Water Results Package* developed in September, 1997 to guide EPIQ's next three years has as its goal "to develop policy recommendations that will assist the Government of Egypt in improving the efficiency and productivity of its water resources." The EPIQ team's examination of water resource issues will place particular emphasis on potential improvements in irrigation system management, improvements in the distribution of water among farmers, farm level improvements in water management, and efforts to increase water user participation in decision-making. The team will also analyze deep and shallow ground water and agricultural drainage water.

The EPIQ *Work Plan* of 9/97 does not indicate any specific plan for collecting primary data. However, the EPIQ team has ready access to the Ministry's extensive data on water supply and distribution. Also, the sociologist who will begin work in January, 1998, may work with GreenCom III (see discussion immediately below) to survey individual water users.

9. GREENCOM III

GreenCOM is USAID's Environmental Education and Communication project, international in scope and centrally coordinated from Washington, DC by the Academy for Educational Development. In response to requests from USAID missions, GreenCOM conducts field work and applied research to enhance environmental sustainability. GreenCOM Egypt was launched in May 1995 to assist a newly-created Water Communications Unit (WCU) in the MPWWR to educate the Egyptian people about the need to conserve water and prevent its pollution. GreenCOM Egypt III, follows two earlier phases. It was initiated under APRP in May, 1997.

According to the GreenCOM *Draft Inception Report*, (October, 1997) GreenCOM III contemplates several surveys as part of its Monitoring and Evaluation Program. The plan calls for four baseline surveys with follow-ups. The first study is a census of the District Engineer in charge of each of the (approximately 180) MPWWR Districts. The data collection phase was completed in October, 1997 and the draft Final Report is expected by December, 1997. It is a "Knowledge, Attitude and Practice" (KAP) survey intended document the respondents' background, exposure to communication messages, knowledge of the water situation in Egypt, relations with farmers and general attitudes.

A larger survey is also planned by GreenCOM III, a KAP survey of 2000 farmers nationwide. This survey will solicit knowledge of and attitudes toward water as a limited resource, the role of the MPWWR and its staff, farmer and wife's roles and responsibilities, water user's associations, practices regarding on-farm water management and crop selection, and exposure to existing messages on water scarcity. Wives of twenty percent of male respondents will be interviewed separately. The sample will be stratified according to location on the water distribution system, with half allocated to farmers in head-ends of distributor canals and half to farmers in tail-end areas. Details remain to be planned, but the survey will be contracted out to a private firm. This survey is to be repeated prior to the close of the project in order to evaluate impacts. No details of the sampling procedures or questionnaire were obtained.

Another aim of GreenCOM III is obtaining survey-based information on the knowledge, attitudes and practices of the general public. Because of inadequate resources to mount such a survey on its own, the project plans to adopt the "Omnibus" survey technique. This approach involves purchasing space (for about ten questions) on a composite questionnaire administered by one of several commercial firms periodically conducting national household surveys. Questions focus on: previous exposure to to media messages dealing with water supply and pollution, knowledge of and attitude toward Egypt's limited water supply situation and pollution prevention. No details of the sampling procedures or questionnaire were obtained.

The project will also conduct a study of policy-makers designed to gain understanding regarding the attitudes of a sample of Egyptian Government officials toward key policy reforms. This group will be drawn from government officials dealing with water, mainly MPWWR. Because of the nature of the subject matter and the limited potential sample size, this study will be qualitative. No details of the sampling procedures or questionnaire were obtained.

10. MONITORING AND EVALUATION OF PRIVATIZATION

IBTCI (International Business and Technical Consultants, Inc.) is monitoring progress in the GOE's multi-sectoral and far-reaching privatization program. Arthur Anderson actually assists the GOE, particularly the MPE's PEO, in valuing public companies to be privatized and preparing privatizations under the PIDP project.

IBTCI produces a very detailed quarterly report that summarizes accomplishments in the privatization program, changes in laws and regulations affecting private investment and financial markets, macroeconomic performance indicators, and developments in various donor-funded programs relating to privatization and private enterprise development. IBTCI also occasionally issues special reports on topics such as capital market development (see IBTCI, August 1997).

IBTCI does not plan to evaluate in depth the performance of privatized companies, because it argues that impacts are likely to be minimal in the short to medium term. This is particularly true for IPOs, where the holding companies retain the largest ownership share and hence management control. Key "private sector" owners often turn out to be public sector "commercial" banks and insurance companies. Without changes in management, operations, and staffing, recently privatized firms are unlikely to perform any differently than they did before privatization. And until the holding company shares of a privatized firm are less than 25%, the Central Auditing Agency examines the company's books.

IBTCI does evaluate important policy issues in its routine quarterly reporting. This is intended to provide rapid feedback to the GOE, USAID, and other readers of its reports. IBTCI feels strongly that this periodic, rapid assessment of progress, problems and impacts is practical and feasible.

11. AVAILABILITY AND QUALITY OF MALR AGRICULTURAL DATA

In the Ministry of Agriculture and Land Reclamation (MALR) the Economic Affairs Sector (EAS) is the main department responsible for collecting, tabulating, and publishing agricultural data. This department makes data and statistics available for all types of users. The EAS consists of two main divisions: the Central Administration for Agricultural Economics (CAAE) and the Central Administration of Planning and Information (CAPI).

The CAAE collects, tabulates and publishes current statistics. It contains seven main divisions: Agricultural Census, Sampling General Directorate, Current Agricultural Statistics, Agricultural Finance, Food Security Projects, International Trade and Consumption, and Livestock, Poultry and Fish Statistics. Between them these departments produce statistics on agricultural production, farm-gate prices, costs of production, and other similar data. The CAPI contains most of the available computers for the EAS. It's main function is to process data and maintain the required data bases. The EAS also tabulates and publishes data produced by other departments of MALR and by other ministries (MTS, MPWWR, PBDAC, CBE) and organizations (CAPMAS). Such data include, for instance, estimates of cultivated area of fruits and vegetables, data on livestock and international trade for agricultural commodities.

11.1 Types of Available Agricultural Data

One of the main publications of the EAS is the "Annual Bulletin of Agricultural Economics", the main source of official agricultural statistics in Egypt. This agricultural statistical yearbook contains, among others, data on the following:

1. Components of Agricultural National Income.
2. Total production and consumption of food commodities (food balance sheet)
3. Cropping pattern and land uses.
4. Area & production of field crops, vegetables & fruits at the governorate level.
5. Costs of production per feddan for field crops and some vegetables.
6. Averages farm-gate prices for main crops.
7. Monthly distribution of agricultural labor.
8. Number of farm livestock at the governorate level.
9. Production of meat & dairy products.
10. Fish production.

11.2 Methods of Collecting Agricultural Data

The EAS collects data via the agricultural census, annual crop cutting surveys, regional reports, estimates obtained from persons with professional experience and estimates obtained from models.

11.2.1 Agricultural Census

Egypt started conducting an agricultural census immediately following the international agreement in 1928. Since that time six have been conducted: in 1929, 1939, 1950, 1961, 1982, and 1990. All of these were carried out two years after conducting the population census. This provided an up-to-date sampling frame for the census at a considerable savings in time and money. Data obtained from agricultural census is the most detailed and accurate data available on the Egyptian agricultural sector.

11.2.2 Crop Cutting Surveys

Egypt start applying the crop cutting techniques in 1955 to estimate cotton production and yields. In the early 1980s, through a major USAID project aimed at improving data collection, this technique was further developed and extended to the main field crops, especially cotton, rice, maize, wheat, and potatoes.

11.2.3 District and Governorate Reports

Each District and Governorate produces its own statistics from reports of agricultural extension agents. The team conducted a field trip to examine how the collection system for agricultural statistics operates at these levels. Based on visits to two districts spread across two separate governorates the descriptions were not consistent between the district and the governorate levels so these impressions should be taken as a point of departure for further investigation.

The agricultural districts are covered by extension agents, each of whom has 150-300 feddans to follow. The agents advise farmers and collect MOA crop and livestock input and output data. Each agent has a structured notebook in which to record information on each farmer for each of the four main crops: cotton, rice, maize and wheat. It looks as though each agent collects data for these four crops by field. He records area, crops, inputs and outputs for each field. He also records data on livestock. The structured notebook is the same nationwide for the same crop.

At the appropriate reporting period the agents summarize information on their farmers and pass it to the district level. This is supposedly a census of all farms producing a specific crop. In one district about 60% of the agents produce consistently reliable data; the others require concerted follow-up to get good data. We did not get a similar estimate from the other district.

Once the data are sent to Cairo, the Sampling General Directorate selects 50% of all farms at the district level and sends the list of names to a separate Acreage Authority which physically remeasures their cotton, rice, maize and wheat fields to verify the quality of the area data collected by the extension agents. According to all parties, this is an independent service not under the District Director of Agriculture, so it should provide an independent estimate. In Dakahlia Governorate the estimates of total cultivated area coming from the extension agents differed from those measured by the Acreage Authority by slightly less than 2% for rice, 1% for cotton and 1/2% for wheat and maize based on the most recent completed season for each crop.

The similarity of the two estimates, if sustained by further investigation in other districts and governorates, suggests that the Acreage Authority may represent a source of manpower for conducting verification surveys. Data from the verification surveys can then be combined with regular MALR data on a farm by farm basis to produce high quality data for numerous purposes, including monitoring and impact assessment studies. On the other hand, the similarity in the data, given what one might expect to be normal sampling error in measuring known, defined fields by separate measuring teams, at least raises the possibility that the verification done by the Acreage Authority is not, in fact, independent of the data reported by the extension agents.

The potential usefulness of the current system, if its accuracy can be confirmed, coupled with the relatively low cost of modestly expanding the data collected by the Acreage Authority, certainly warrants a more comprehensive investigation into the MALR data collection system to assess the quality of its data on a wider scale.

11.2.4 Estimates Obtained from Persons with Professional Experience

These estimates are mainly judgement statistics obtained by agricultural engineers, agricultural extension supervisors, and agricultural experts at the district and governorate levels. They cover such things as cultivated area, yield per feddan, and production for other field and vegetable crops. These estimates are collected at the district level, aggregated at the governorate level and then sent to the headquarters of the Central Administration of the Agricultural Affairs (CAAA) in Cairo. A committee consisting of representatives of EAS and CAAA and other related departments examine these estimates and compare them with estimates from other sources and with the time series data before announcing the official statistics.

11.2.5 Estimates Obtained from Models

This method is used to estimate statistics on livestock, meat and dairy products. However, these models and the technical coefficients they use need to be adjusted from time to time.

11.3 Data Quality

The quality of data produced at both the governorate and district levels appears to be good. The GTZ cost of production surveys will provide an opportunity to confirm this and, perhaps, provide some direction on how to improve it. Data available on new lands are not as detailed as data on older lands. The survey for the New Land Development Study conducted in 1993/94 (see Section 8 of this Appendix) provides the best source of statistics for the new lands. RDI may be updating this study in the near future.

The impact assessment planning team recommends that MVE conduct a broad-based survey of the quality of agricultural data at the district and governorate levels in order to evaluate their potential for impact assessment purposes. It may be that MVE can save considerable time and effort by identifying the strengths and weaknesses of the current and building on that.
Such a study would have to be done by someone who is fluent in Arabic and experienced in field survey data collection in order to catch most of the nuances relating to supervision, reporting, synthesizing and reporting that are typical of extension based administrative statistics.

APPENDIX C
SUBSECTOR STATUS REPORTS

This appendix summarizes key policy reforms, progress and obstacles in three priority subsectors. Each section provides an historical overview of recent changes and a summary of outstanding reform issues and problems that need to be addressed.

1. FERTILIZER SUBSECTOR

The Principal Bank for Development and Agriculture Credit (PBDAC) monopolized the receipt and distribution of locally produced and imported chemical fertilizers before 1990. These fertilizers were distributed to farmers through farmer cooperatives on the village level at prices predetermined by the government. The geographical pattern of fertilizer use was governed by the allocative decisions of the Ministry of Agriculture and Land Reclamation (MALR) rather than farmers' decisions in response to price signals in a market economy. The high level of fertilizer use was achieved without market oriented systems.

The prices paid by farmers for these fertilizers were highly subsidized until 1988 when the Egyptian government began a policy of gradual reduction of the fertilizer subsidy, which was completely eliminated by 1992. Even though economic reform in the Egyptian agricultural sector began in 1986, the Economic Reform and Structural Adjustment Program (ERSAP) for the whole economy only started in 1990. One of the policies included in the in the ERSAP was the limitation of PBDAC functions in the trade of agriculture inputs including chemical fertilizers, with a greater role to be played by the private sector firms. By the 1993/1994 agriculture year PBDAC received and traded only in 0.3 million tons of fertilizers out of about 6.0 million tons of local production. A vibrant and competitive fertilizer distribution system had emerged to take on this critical input marketing function.

1.1 The Fertilizer Crisis of 1995-96 and the GOE's Response

In mid-1995 a "fertilizer crisis" occurred that led to a shortage of fertilizer in local markets. Several factors contributed to this shortage (see Verification Report, APRP, Tranche I). Mainly it was due to the need for major repairs and maintenance made by two (out of the five domestic) factories at the same time. Fertilizer exports also contributed to the perceived shortage. In response, in August, 1995, the GOE instructed the producing factories to deliver all their production to PBDAC, effectively restoring the monopoly, government-run distribution system for chemical fertilizers. Fertilizer exports were curtailed but the private sector was allowed to import about one million tons of nitrogen fertilizer, with the import duties exempted (but not permanently removed).

On January 15, 1996, instructions were given by H.E. the Minister of Agriculture and Land Reform regarding distribution of local fertilizer production as follows:

PBDAC	87 percent
General Cooperative for Agrarian Reform	8 percent
General Cooperative for Land Reclamation	5 percent

This completely eliminated the role of the private sector in the trading of locally produced fertilizers until imports became available. However, by the time the imported fertilizers arrived

in Egypt, local factories had returned to their normal production pattern. Coupled with decreased seasonal demand for fertilizers , this lead to increased stocks for both PBDAC and the private sector.

1.2 Back on the Fertilizer Reform Track

By July 15, 1997, instructions were given by H.E. the Minister of Agriculture to redistribute the share of the locally produced fertilizers (80 percent) as follows:

PBDAC	49 percent
Private sector & coops	38 percent

The private sector was allowed to export up to 10 percent of its share[1]. However, in December 1996, PBDAC had signed contracts with the producing factories to receive 87 percent of local production. It is not known whether the latest instructions are really in effect and what role the private sector is now playing in the trading of fertilizers. It is expected that PBDAC will continue to abide by the contracts made with the producing factories until the termination date of these contracts, with no role played yet by the private sector.

It is not clear what will happen at the beginning of 1998 and whether the new instructions will then be in effect or not. If these instructions are in effect by early 1998, they will assure increased competition in the marketing of fertilizers. The best policy would appear to be elimination of predetermined quotas so the market can determine the share of each of the public and private sector participants in fertilizer distribution.

2. COTTON SUBSECTOR

Historically, cotton is considered one of the most important export and cash crops in Egypt. The GOE has been monopolizing the Egyptian cotton sector more than 30 years, in terms of area planted (production), marketing, pricing, processing and cotton input markets.

The liberalization of the cotton sector began with actions of the government in 1988-89 to increase procurement prices for farm-gate seed cotton. At that time the GOE wanted to reduce the gap between domestic cotton prices and world market prices. This was seen as necessary to reduce the potential severity of the adjustments that would be required when market liberalization occurred.

In late 1992 and early 1993 the GOE agreed to establish a free -market system for cotton production and marketing beginning with the cotton crop planted in 1993. The GOE also agreed to eliminate compulsory delivery of cotton and allow free and equal access to all markets by any

[1]From the Arabic wording of the instructions, it is not clear as to whether the private sector share is divided as follows: 3.8 percent for exports and 34.2 percent for local distribution, or 10.0 percent for export and 28.0 percent for local distribution.

private or public trader. Thus, the 1994/95 cotton marketing season should be considered the first year of cotton market liberalization.

For the 1994/95 marketing season the government established a guaranteed floor price system. Major objectives of the floor price policy were :

a) Stabilize cotton prices at the producer level.
b) Stabilize the incomes of cotton producers.
c) Stabilize domestic cotton production.
d) Exploit the comparative advantage of the country in cotton production, especially for extra long staple (ELS) and long staple (LS) varieties.

2.1 An Overview of the Structure of the Cotton Industry

Most Egyptian farmers grow cotton at one time or another, though in any given year only about 500,000 are growing cotton because of the crop rotations. The cotton/textile subsector includes producers, coops, PBDAC sales rings, public and private traders, public and private ginners, spinners, weavers, manufacturers of ready made garments (RMG), and input service agencies.

In general, the Egyptian cotton economy is affected by policies which influence :

a) Cotton production and income of cotton producers through the price of seed cotton.
b) The efficiency of the marketing and ginning subsectors.
c) The export performance of the cotton industry.
d) Input markets related to cotton production.
e) The profitability of competing crops.

2.2 Production and Marketing of Seed Cotton

Allowing Egyptian farmers full freedom in decision making in their cropping program in 1993 was a significant change for the cotton subsector. The area planted to cotton declined in 1994 and 1995. As shown in Table C-1, actual prices received by farmers declined slightly in 1993, and discouraged plantings in 1994 and 1995. A significant increase in cotton area did occur in 1996, which can attributed to the very favorable cotton prices of 1995 and the high floor prices announced for 1996.

Private traders had their first opportunity to buy seed cotton in 1994-95, and they purchased one third of the crop. In 1995-96, private and public traders competed for the relatively small crop, driving prices up. The private sector increased its share to about 60% of the seed cotton.

TABLE C-1 : AREA, YIELD AND PRODUCTION OF SEED COTTON, 1990-96

Year	Area (feddans)	Yield (kentars/feddan)	Production ('000 kentars)*	Procurement Price** for Giza 75
1990	993,047	5.21	5.169505e+27	2.37277298281e+20
1991	851,283	5.93		
1992	840,267	7.15		
1993	884,310	7.78		
1994	721,443	6.00		
1995	710,207	5.72		
1996	929,757	6.13		

Source: MALR and Krenz, *Liberalization of Cotton Marketing in Egypt, 1993-1997*

* Note: A kentar of seed cotton equals 157.5 kg.

** Note: Technically, the procurement price was a floor or minimum price as of 1995.

In 1996-97, the guaranteed floor price of cotton, set in February 1996, ended up being higher than the world market price by harvest time. Consequently, private traders stayed out of the cotton market. In that year the GOE paid about LE 700 million to subsidize the relatively high floor price for cotton producers. A survey of 312 cotton farmers in 8 governorates in Nov.- Dec. 1996 showed that:

a) Farmers received their payments for cotton sold to PBDAC sales ring although with some delay.
b) 62% of producers thought that the government was making a profit in buying cotton at the floor price.
c) Lack of market information, especially related to cotton floor prices, was reported by about 87% of the sample.
d) A deficiency payment system would allow the private sector to participate in the seed cotton market when the GOE maintains a floor price above world market prices. This would necessitate development of a monitoring system in order to determine whether farmers are receiving the floor prices.

2.3 Ginning and Textile Mills

During March-April 1997, a researcher for GTZ's Cotton Sector Promotion Program (CSPP) interviewed officials (mainly managers) of many cotton trading, ginning and spinning companies (both private and public) regarding cotton marketing topics, especially those relating to current liberalization and privatization policies in that important subsector. The conclusions of the study can be summarized as follows:

a) There is considerable over capacity among the 72 gins currently operating nationwide.
b) Most of these gins are old and require a lot of hand labor.

c) The ginning charges were set by the GOE at 14.5 LE/kentar of lint some years ago and have not changed since. There is insufficient incentive for improving the quality of ginning.
d) 18 public gins were leased by private companies in 1994-95.
e) Two of the five public sector ginning companies have been sold to the private sector, and privatization is being considered for two other public ginning companies.
f) Many of the gins are attractive to the private sector because of their high land value, due to their prime locations in major cities.
g) Privatization of the textile mills has not really started. Excess labor, high debt burdens and a scarcity of operating capital are still hampering their profitability and diminish their attractiveness to potential investors.
h) Many mills have large inventories of unsold products because of poor marketing.

2.4 Cotton Exports, Imports, Spot and Future Markets

Major findings could be summarized as follow:

a) Egyptian cotton exports have during the last decade varied heavily from one year to another (between 51,000 and 358,000 bales). Consequently, foreign textile mills working with extra fine cotton have turned to U.S. Pima, the export market share of which has expanded considerably.

b) ALCOTEXA sets weekly minimum export prices for different Egyptian cotton varieties; these prices are set as the marketing/export season opens on September 15 of each year, and tend to move only upwards rather than fluctuate according to supply and demand.

c) Egypt opens its export season only on a specific date in September, so that all buyers have to wait. By contrast, most of the US Pima crop is contracted for

ward while it is still in the ground.

d) Egypt could gain very much by exporting its high quality LS and ELS cotton and importing short and medium staple cotton for local spinning and textile manufacturing. Rules for lint imports must be stated clearly and simply.

e) GOE should establish a committee consisting of all ALCOTEXA members to determine whether the cotton spot market, Mina El Bassal, should remain open. By contrast, there may be a need for a cotton futures market in Egypt.

2.5 Concluding Suggestions about Monitoring & Impact Assessment Priorities

a) It would be helpful if the CSPP would publish standard errors for important sample estimates derived from its survey. The sample of 300 cotton growers in 8 governorates represents only 0.06% of the total population. It may have been too small to serve as a basis for generalizing its findings.

b) A field survey of domestic cotton traders (both private and public) would provide an accurate figure concerning the extent to which the private sector is participating in the domestic cotton market.

c) Coordination between MVE and RDI activities is needed in order to obtain a broad picture concerning the Egyptian cotton economy.

d) A follow up of the privatization program in the ginning, spinning, weaving and RMG producing industries should take place in order to evaluate and investigate the potential effects of that privatization on :

1) New investments in these businesses.
2) Employment and labor productivity.
3) Adoption of Improved technology in the cotton subsector.
4) improvement in marketing efficiency in that industry.

3. WHEAT SUBSECTOR AND POLICY REFORM OVERVIEW

Wheat, and its main derivative, bread, are the most significant elements in the Egyptian diet, providing more than one third of the daily caloric intake of Egyptian consumers. In 1996, average per capita consumption of wheat amounted to 197 kg/year, constituting one of the highest levels of per capita wheat consumption in the world. Due to increased profitability relative to other crops and the use of better yielding and more resistant varieties, domestic production of wheat has increased significantly during the past few years, satisfying 47 percent of domestic consumption. Given the strategic importance of wheat and bread for Egypt's food security, the Egyptian government considers wheat as a high priority subsector.

Dr. Abla M.Abdl-Latif (1997) summarized evolution of the current (as of May 1997) wheat policy environment as follows:

- The economic reform that started in 1987 included the cancellation of mandatory deliveries and the replacement of the procurement price with a floor price for wheat.

- Widespread liberalization of the sector took place in 1992 when the private sector was allowed to import 72 percent extraction wheat flour and bran.

- Both public and private millers were given permission to produce, exchange, transport and trade in the 72 percent extraction wheat flour and procure the needed wheat from the domestic and/or foreign markets.

- All handling, processing, transport and distribution of the 82 percent extraction wheat flour remains under the control of the government.

IFPRI (1997) examined the wheat subsector in Egypt in greater detail. The study identified policy options to strengthen the emerging private marketing system for wheat, while minimizing the cost of transition to a private-sector-based system. The study concentrated on two main tasks: a) determine existing wheat market imperfections and develop preliminary hypotheses regarding government support and regulation of wheat and wheat flour trade and marketing; and b) identify policy scenarios to reduce potential negative impact of reforms on producers, consumers, and price stability.

Prior to 1987, wheat production, marketing and trade were heavily controlled by the government through compulsory wheat area allocation and procurement quotas. These quotas were replaced by optional deliveries at fixed prices, which were raised significantly, and are now close to international prices. By 1993, public mills and private traders were allowed to import wheat grain to be milled into 72 percent flour. However, the marketing and imports of wheat grain for transformation into 82 percent flour are still controlled by the government. Subsidies on 72 percent and 76 percent wheat flour were eliminated in 1992 and 1996, respectively. However, the subsidy on 82 percent wheat flour and baladi bread remains, creating significant annual subsidy costs. The government still intervenes in wheat trading by imposing ceilings on the sale prices of 72 percent flour, and by restricting local millers from producing 82 percent flour from local wheat and 72 percent flour from imported wheat. These restrictions create incentives for excessive consumption, leakage and waste of subsidized flour and bread.

3.1 IFPRI CGE Model Findings

In 1994-95 IFPRI surveyed 2000 wheat traders in 18 governorates to examine the structure and operation of the wheat marketing system some ten years after the initiation of the reform process. A Computable General Equilibrium (CGE) model, based on 1994/95 data, was used to simulate quantitatively the short-run equilibrium effects of changes in three critical areas of wheat policy: a) consumer subsidies, b) producer subsidies, and responses of the domestic economy to changes in international wheat prices under alternative policies, including a tariff-based mechanism for limiting domestic price instability.

The results show that changes in the wheat sector may have a strong impact on disaggregated household welfare and on the agriculture sector, but much smaller effects on macro indicators such as real GDP and unemployment. The more specific findings are as follows:

- Elimination of the bread and flour subsidies for all households would raise the budget surplus by around 0.6 percent of GDP. The negative welfare impact will be most heavily felt by low-income households, whose welfare would decline by about two percent.

- Substituting a wheat-maize flour blend (with 20 percent maize) for all-wheat flour in the production of subsidized bread will lead to a reduction in subsidy spending.

- Subsidizing wheat producer prices to raise the self-sufficiency ratio of wheat would be very costly to the government, in addition to leading to a drastic redistribution of income in favor of the rural population.

- Fluctuations in wheat international prices lead to large changes in the government subsidy costs and foreign exchange needs.
- The results under alternative scenarios of wheat and flour subsidies and self-sufficiency ratios, show that price increases boost wheat production, raising self-sufficiency and agricultural incomes but reduce household welfare, especially for the urban poor.

- The use of flexible import tariffs to keep domestic prices at the level of a three-year moving average of world prices shows that such a policy reduces the fluctuations in household welfare, factor incomes and wheat self-sufficiency by around two thirds.

3.2 Policy Reform Implications of the IFPRI Wheat Marketing Survey

Some important implications of IFPRI's work on wheat marketing are as follows:

- *Improve the Policy Environment for Wheat Marketing*. There is no specialized wheat marketing sector yet that can be targeted by policy. Therefore, improvements in the overall environment for private sector participation in domestic agricultural trading, more than specific policies for the wheat trading sector, are necessary to promote the emerging private wheat marketing sector.

- *Ensure Consistency and Continuity in Policy Changes*. The frequent and inconsistent changes in policies raise the level of uncertainty with respect to investments and expansion of private sector activities in the marketing sector. New policies should be subjected to rigorous ex-ante evaluation to ensure consistency and stability in the policy environment.

- *Encourage Long Distance Trading and Improving Integration among Regional Markets.* Policy changes need to be adopted to encourage private sector involvement in long-distance trading and to improve linkages between local markets. The projected studies of the subsidy system and the milling sector should provide the needed information to propose a consistent package of policies for wheat marketing and milling and bread pricing.

- *Subsidy Cuts and the Poor*. It is preferable to improve targeting but avoid dismantling support to low-income households unless alternative price stabilization measures have been put in place.

- *Price Stability*. The CGE simulations suggest that a flexible tariff keeping domestic wheat prices at a moving average of international prices could effectively reduce the transmission of international price instability without any significant negative side effects.

3.3 IFPRI Plan of Work to June 1999

IFPRI prepared a work plan for the period April 1997 to June 1999 that covers:

1. *Food Subsidies*. IFPRI will assess a) the economic impact and targeting of food subsidies, and b) the political feasibility of subsidy options.

2. *Income and Employment Generation*. IFPRI will prepare the following analyses: a) poverty profile, b) study of the determinants of unemployment, c) study of the determinants of access to micro enterprise credit, d) macro/micro impacts of subsidy options, e) a case study of PBDAC rural finance services, and f) a case study on settlement of newly developed lands project.

3. *Foodgrain Market Liberalization*. IFPRI will complete the following studies: a) milling sector survey, b) wheat producer survey, c) study on the wheat market price formation process, d) study on adjustment of wheat producers to market reforms, and e) study on the expected response of producers to liberalized wheat markets.

The various IFPRI studies will provide a baseline on the wheat subsector, including information on the following variables:

- Changes in private sector participation in agriculture marketing and agribusiness.
- Changes in marketing margins.
- Changes in employment.
- Changes in producer and consumer incomes and welfare.
- Price stability.
- Reduction of subsidy cost.

APPENDIX D
GOALS AND INDICATORS: SOME SUGGESTED REFINEMENTS

In reviewing the APRP Goals and Indicators, some of the APRP objectives and indicators identified for measuring impacts are not necessarily consistent with two of the goals: increased productivity of public and private investments in land reclamation (C.1) and improved allocation of water (C.2). Achievement of several objectives in Section C would not necessarily contribute to achieving these goals or lead to an improvement in the economic welfare of the population of Egypt. In particular, several of the objectives as now stated seem to ignore significant economic and hydrologic realities of Egyptian agriculture; they emphasize the benefit side, but ignore costs associated with implementing land and water policy initiatives. In this appendix we examine these objectives and propose an alternative formulation that is more likely to contribute to attaining these goals.

The question of precisely specifying objectives is important. Although convenience of measurability needs to be considered, it should not become the driving force; objectives should be chosen more for relevance than convenience. To do otherwise is to risk obtaining a correct answer to the wrong question.

1. OBJECTIVE C.1.1: SPECIALIZING IN HIGH VALUED CROPS ON RECLAIMED LANDS

This objective is problematic, in that it assumes that growing high valued specialty products (such as perishable fruits and vegetables) is a sufficient condition for achieving the overall goal of improved economic return to investments in reclaimed lands. This assumption may not be true. High valued crops do, by definition, generate more income per acre than most conventional field crops. However, they tend to generate correspondingly higher costs of production that include not only fertilizer, pesticides and labor, but also scarce managerial skills and risk-taking predilections on the part of owners.

Specialty crops are more subject to both production and price risks. For many of the newly reclaimed lands, markets are distant, so revenues for perishable products must account for special transportation and storage expenses. From the nation's perspective, demand for specialty crop outputs is not perfectly elastic with respect to price. Neither the domestic nor export markets may be able to absorb as much specialty crop output as Egypt is capable of producing during particular market windows (early/late season; counter-season) without significantly driving down prices. The high returns over out of pocket costs are, thus, a signal not only of the scarcity of the specialty products themselves, but also the scarcity of the favorably located water and land resources needed to produce them and the technical, managerial and entrepreneurial skills required to pull it all together. Because of this many farmers, in developed and developing countries alike, prefer to limit production of specialty crops, balancing such crops with less costly and less risky crops.

This objective would be better stated as “Farmers on reclaimed lands choosing cropping patterns that are economically efficient after considering all costs.” The objective could then be verified by means of cropping system studies that identify efficient and inefficient cropping patterns, with annual follow up studies to document the extent to which those patterns are being followed on the new lands.

2. OBJECTIVE C.2.2: INCREASE WATER USE EFFICIENCY IN THE NILE IRRIGATION SYSTEM

In the context of irrigation water management, the term "water use efficiency" usually refers to a technical measure of efficiency, a ratio of physical output to physical input. In the case of irrigation, there are numerous efficiency measures, but they mainly refer to the ratio of water usefully evaporated and transpired from plants and soils o the amount diverted to the farm (or perhaps the region). Water management techniques which improve technical water use efficiency, such as shifting to more efficient water application techniques (lined ditches; sprinklers, etc) are not cost less, and therefore do not necessarily improve the economic efficiency of water allocation.

Further, the geographic area for which technical efficiency is calculated is crucial. For example, it is typical in the Nile irrigation system that water use efficiency on the farm is low (30-50%), reflecting the fact that the farmer applies water liberally, well above crop needs. However, because water applied in excess of crop evapotranspiration requirements returns to the River via the drainage system, or via underground aquifers, the "wasted" water is subsequently available for reuse (although somewhat degraded in quality). Therefore, even though in the Egyptian irrigation system farm-level irrigation efficiency is low, system efficiency (considering the entire irrigation service area from Upper Egypt to the point where drainage waters are released to the sea) is relatively high (Keller and Keller, 1995). Steps which improve on-farm water use efficiency may not improve system efficiency, but will cost resources to accomplish.

Improvements in water use must be scrutinized carefully to assure that they lead to an improvement in basin wide economic efficiency with respect to the allocation of water. Interventions which reduce evapotranspiration (such as changing to crops which transpire less water), rather than simply reducing applied water, are more likely to improve system-wide economic efficiency than those that just increase technical efficiency. Substitution of sugar beets for sugar cane or cotton for rice are said to save real or "wet" water in this way in Egypt.

An economic statement of this objective has more generality. The objective could be stated as "Increase the economic efficiency of water use in the Nile irrigation system." In the economic sense, improved allocation of water occurs when the net benefits to the scarce water, land and capital resources are maximized. Only when a policy intervention yields more in incremental value of output than the associated incremental cost is the allocation of water and other resources improved. This is measured by a benefit-cost ratio (a ratio of incremental benefits to incremental costs) or by a net present value or internal rate of return computation.

3. OBJECTIVES C.3.1; C.3.2; C.3.3: ENHANCED SUSTAINABILITY OF EGYPT'S AGRICULTURAL PRODUCTION SYSTEM

Each of the three objectives under C.3. could benefit from reformulation as well. C.3.1 is "Improved water quality", and C.3.2 is "Reduce soil salinity and waterlogging". Water quality and soil salinity are both technical measures, so a critique of C.3.1 and C.3.2 would be similar to the discussion above regarding water use efficiency. Improving either of them would yield

some benefits, but would also involve costs (either as expenditures or as foregone benefits). Hence, assessing the impact of these sorts of improvements requires an evaluation to determine if the benefits exceed the costs. Some water quality improvements will justify their costs, but many will not. Similarly, some accumulation of salinity in soils is an inevitable consequence of long-term irrigation in an arid climate. Recognizing that evaluation of proposals to reduce salinity and waterlogging are complex dynamic optimization problems, such proposals are best assessed by balancing the long-term economic benefits against the economic costs.

Objective C.3.3 states: Increase crop productivity per unit of land. As a measure of productivity, such a simple calculation has important limitations. In effect, it attributes all productivity gains to the land resource, and does not recognize the contribution of other inputs, such as capital, water, labor, publicly supported research and extension, etc. Productivity is better measured in total factor terms, or in terms of the independent contribution of individual inputs to total productivity. Section 5.2.1 describes how to approach this subject with data that is readily available.