EGYPT’S FUTURE DEPENDS ON AGRICULTURE AND WISDOM

Lowell N. Lewis

“Whoever does not command the means to feed himself can neither feel freedom nor dignity”

Mohamed Hosni Mubarak.”
Dedication

To: My wife, Montserrat Trueta,
For her patience and support, her editorial help and her interest in Egypt
To: My children, Beth, Brad and Nancy for their personal support and
their interest in my interests.
To: My friends and colleagues in Egypt whose patience with an
American created my fascination for their country.
To: My colleagues at the University of California who encouraged me.
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Preface

The Purpose of this Book is to provide an analysis of present day Egypt that will suggest appropriate pathways to maintain and improve the economy of the country and the quality of life of the people. The present day picture is based on the history and the 20th century chronology of events that have brought the country to its present day position. It is my philosophy that the growth of the country’s economy and the employment of the people will be based on the success of its agriculture. Egypt is the story of people and the management of natural resources through the dimension of time. The value of the analysis given here transcends the boundary of a nation and time. It forms a model/modality for the goal of sustainable development and use of resources which are meaningful globally. The leaders and people of every developing country are attracted by the miracles of technology and its potential to solve all the problems of a society. These miracles are important but no more so than the knowledge of a country's basic resources, its history and its culture.

During these years there have been many changes in the economy, structure, scientific basis and international standing of agriculture in Egypt. They serve as examples of what can be done in developing an agricultural economy with severely limited land, arid conditions, and cooperation with the support of western countries including Canada, Germany, France and the United States. The events of this period provide a background for other developing countries and for donor countries and should be a foundation for the continued development of Egypt and the other MENA countries.

This is a report of the many changes and how they were accomplished. It is an analysis of the present economic and population challenges facing Egypt and it suggests future directions essential to Egypt’s future. It concludes that Agriculture is essential to Egypt’s well being.

A Note of Recognition

There are many key people who are a part of the story. One who lived, worked and contributed continuously is Yousef Wali. After obtaining a doctorate at the University of Arizona in, he became a professor at Ayn Shams University and built a career as an expert in horticulture. In the early 1970’s he became a consultant to the Ministry of Agriculture. In 1982 he became the Minister of Agriculture where he served until his
Throughout his career, Dr. Wali worked to improve food production, increase Egypt’s independence through a sustainable food supply, and develop a scientific base for agriculture. The motto he often quoted, “He who does not own his food, does not own his freedom” underlines his basic efforts and beliefs.

His diligent work with every component of science, agriculture and business throughout the world helped put Egypt in a better economic and food supply position. This meant cooperation with numerous aid agencies of the USA, Canada, Germany, France, and the European Union and with Israel, and the Arab League. It meant debating the policies of the World Bank and the International Monetary Fund. It meant convincing most of his own colleagues, the Parliament and the other Ministers of the Egyptian Government of policy changes. He knew what needed to be done and he had a good sense of what could be done. The result was a constant debate and compromise to bring Egypt to its present economic and social position.

A second person is Dr. Adel El-Beltagy. During the NARP years, he was Chairman of the Board of the ARC and Director General of NARP. Then he became the Director General of ICARDA and today, he serves as the Chairman of the Global Forum on Agricultural Research He is a life long friend and an inspiration in writing this text. A great pleasure of these years has been working with him and knowing his family. Numerous Egyptians have always been available to encourage, critique and provide understanding to me and to the programs of joint interest. The alphabetical order is used to indicate their equal value to me and to the programs discussed in this report.

Abdel F. Mohamed Metawie, Chairman Nile water sector
Abdel Aziz Elsherif, Commercial Attache, Ministry of Commerce and Industry, Egypt
Adel A. Kader, Professor, University of California
Adel M. Aboul-Naga, International linkages
Ayman Abou Hadid, President, Agricultural Research Center
Magdy A. Madkour, creator Agricultural Genetic Engineering Research Institute
Mahmoud Abu Zeid, Minister of Water Resources and Irrigation
World Opinion Recognizes Agriculture

World Development Report

In announcing "Agriculture for Development" as the theme of the World Development Report (WDR) for 2008, François Bourguignon, Sr. Vice President of the World Bank, said that growth in agriculture makes a disproportionately positive contribution to reducing poverty. By illuminating the links between agriculture, economic growth and poverty reduction, the report offers a timely assessment of how agriculture can best foster development.

According to Nathaniel Don Marquez, Asian NGO Coalition for Agrarian Reform and Rural Development (ANGOC) the theme reflects the importance and prominence of agriculture. Many international summits and conferences have declared that there is an urgency to save agriculture from its demise. Beyond policy changes, the restructuring of global governance and institutional reforms are needed so that commitments are translated into actions leading to a renewed interest in agriculture and a return to the basic objective of food security. Unless there is a fundamental shift in the framework or paradigm in which agriculture is currently operated, then agriculture will lead to the dissolution of small farming households. Indeed, agriculture is the bedrock of human civilization. For as long as food security and agricultural productivity continue to be measured by money and markets, it will continue to pull young people away from agricultural life.

A Way of Life or a Pathway to Poverty

Agricultural development has come to mean increasing productivity alone. To speak of agriculture however, is to speak of farmers. For as Tony Quizon puts it, “development is not about money, it is about people.” By definition, farmers include resource poor cultivators, pastoralists, fisher folk, indigenous peoples, women and agricultural laborers. Agriculture is beyond merely an instrument for development, for millions of poor farmers, it is a way of life. Hence, for farmers, it is addressing the needs of the persons rather than merely the productivity of the farm. It is addressing food security and self-sufficiency as the main ticket to survival of a nation as growth is addressed. It is assuring equity instead of mere national economic growth beneficial to and controlled by a few at the expense of the majority. As Fr. Francis Lucas rightly observes, small farmers feel that farming is a condemnation to poverty,
destitution and death. The poor are isolated; they are remote from centers of power and government. They remain largely unorganized with a lack of power. Their access to land, water, technology and other services is tenuous at best. They are the first victims of calamities and political upheavals. Rather than sustaining life, the current global competition for agriculture might mean the extinction of small farmers and farming.

Poverty is the result – not of scarcity, but of mal distribution of resources and power. Compounding the woes is that the small food producers – who remain most vulnerable to hunger and poverty, are landlessness or limited access to productive land. In most rural areas, land remains a major source/determinant of wealth; it is a symbol of prestige and a means to power.

The current crisis of agriculture and farming communities stems from three major trends which exacerbate poverty and inequity:

- first, the promotion of Green Revolution technology without regard for its social and ecological consequences;
- second, the surrender of agriculture policies and farming communities to strategies aimed at rapid urban industrialization; and
- third, indiscriminate liberalization policies which allow the entry and dominance of extremely powerful multinational agribusinesses.

As to the first trend, while the increase of production from the Green Revolution has benefited developed countries and favorable regions of developing countries, these yield increases unfortunately have not reached the rural poor. Green Revolution requires substantial external inputs such as chemical fertilizers and pesticides. While the technology provided yield increases at the start, it was not sustainable in the long term. NGOs criticized the narrow approach of relying mainly on Green Revolution technologies as they are assessed to be environmentally unsustainable and discriminatory to resource poor farmers.

Many new agricultural technologies ignore the complexities of rural life, as well as the cultural and social differences among communities. Indigenous agricultural practices and knowledge that were developed over many generations have given way to the simplified, standardized techniques of the green revolution. The strong sense of values that underpinned traditional agriculture have been overthrown by a production system that is alienated from the community.
Current government policies emphasize meeting urbanization needs and relegate agriculture to the position of support sector. Voices of concern have been raised about the growing bias against agriculture in favor of industrialization, which is thought to be inherent to economic transformation.

*Agriculture versus Industrialization*

Agriculture is viewed merely as a support sector for industry. There is thus an evident lack of emphasis on strengthening producers’ organizations, and their concerns like agrarian reform and access to resources. A major case in point is legislation in relation to land tenure and redistribution. While land and tenure reforms have been enacted in many countries, implementation of these remain fraught with problems. Many policies have failed to make an impact at the local level due to political opposition by vested interests, often in collusion with corrupt officials in government.

As to the liberalization of agriculture, such phenomenon has resulted in trade relations between the big players from the North and the small Southern players becoming even more lopsided. Unfortunately, countries of the South are severely disadvantaged. While their agricultural subsidies are scrapped, and their agricultural trade is liberalized, heavy subsidization of agriculture continues in the North. This leads to massive displacement of agricultural producers, particularly staple food producers, who comprise the bulk of farmers in developing countries. The lure of growing more lucrative luxury crops and non-food items over staple crops increasingly threatens domestic food security. The inclusion of the Agreement on Agriculture under the WTO intensified the dependence of small producers on the external market for production inputs and consequently the already heavy reliance on food imports due to the shifting of land and resources away from food crop production towards export oriented cash crop production. The flooding of local markets with cheap imported (and dumped) food also discourages local production.

The Agreement on Agriculture under the WTO aimed to facilitate the process towards a freer flow of agricultural products among countries. Governments committed to remove quotas, subsidies and tariffs over a period of time. Unfortunately, the current agreement and how it is implemented favored the developed countries to the detriment of developing countries. Agriculture in developed countries continues to be heavily subsidized allowing them to market their products at cheaper price. Moreover, trade barriers are still in place restricting the flow of agricultural products especially those coming from developing countries.
**Imperatives of the Future**

It is imperative that land, water, biodiversity and intellectual practices be under the democratic control of those who produce food. In the run-up to the World Food Summit in April 1996, about 101 NGOs from Asia-Pacific raised the following fundamental principles in reviving agriculture and attaining food security saying agriculture must be:

- built on a vision centered on the integrity of the local farming communities
- based on food security and sufficiency of the national community
- implemented via strategies that promote social equity, ecological sustainability, people’s empowerment and gender balance

According to Thirtle et al. (93) the literature provides overwhelming theoretical and empirical evidence that agricultural growth is essential, especially in the poorer developing countries. It identifies the diverse roles that agriculture plays in the process of growth and development on the one hand, and the link between economy-wide growth and poverty alleviation on the other. Agricultural productivity growth has an impact on GDP growth, both directly and through agriculture’s linkages with the broader economy, that generate increases in non-farm income. Both agricultural growth and GDP growth have impacts on inequality, poverty, and nutrition.

For Egypt there can be no doubt, Agriculture is an essential and basic part of the economy.


**Agricultural Development is Fundamental to Economic Development**

*Peter McPherson, President, NASULGC, USA*

Agricultural development is fundamental to any broad-based economic development on the African continent and agriculture has been shown to produce more equitable growth in personal income than other forms of development. Generating and extending research, knowledge and technology, building African human capacity to conduct research and supporting the capacity of institutions to produce creative and productive people is essential to the process.

In summary, Africa faces a multitude of challenges that will affect how successful development efforts will be. Clearly, agriculture is key to
making that development successful. Successful agricultural development is most directly achieved through investment in human and institutional capacity that will generate the knowledge, technologies and leaders to eradicate famine and food shortages, and build economies that support stable and democratic societies in Africa.

Institute (IFPRI) study shows that agriculture is truly an important engine of growth for Africa. While its role may vary among countries depending on a diversity of conditions, agriculture is an especially strong force in poverty reduction, because it affects the rural poor who are a large component of the poor of Africa. The study concludes “most African countries cannot significantly reduce poverty, increase per capita incomes, and transform into modern economies without focusing on agricultural development.” This conclusion is similar to that of another study of a broad range of developing countries that found that increasing agricultural productivity is the most efficient way to reduce poverty and inequality.

Yet another study of 62 developing countries demonstrates the power of agricultural development to increase national economic growth. The study shows that changes in agricultural productivity explained 54 percent of the growth in GDP per worker and that this increased efficiency, released labor from agriculture to other sectors that accounted for another 29 percent of the GDP growth. The remaining 17 percent of GDP growth is from non-agricultural increases.

Food security is achieved by addressing a wide range of constraints. Some of these constraints are more obvious than others and more amenable to our development approaches. While connection to markets, trade policy and other components of what is termed an “enabling environment” are important elements to national development they will depend on two factors. First and foremost, they depend on well-trained, visionary indigenous people to design, implement and support them. In short, highly educated human capital is essential.

Second, we need to increase agricultural productivity. Most of the recent gains in agricultural production in Africa have resulted from expanding the area of land cultivated and not increasing the production per unit of land area. The implications are not just a decline in per acre production efficiency but a use of more marginal land with ever increasing negative impacts on the natural resource base. Increases in efficiency per acre are the result of improved technologies and access to inputs. The sustainable way to increase efficiencies is to create Africa’s capacity to generate new technologies; that is build the human capacity and build the institutions that generate that capacity—the universities and the agricultural research institutes. We need to make such investments. Evidence from rural
Uganda indicates that public investments in agricultural R&D had the highest impact on poverty reduction of development investments throughout the 1990s. In addition to financial resources, agricultural innovation requires human capital and, therefore, sustaining and improving upon advances in agricultural R&D requires concurrent investments in general education.

Higher Education and research institutes generate knowledge that has economic impact, particularly in agriculture. In a study of more than 1,800 rates of return to research in agriculture the median of the rate of return estimates was 48 percent per year for research, 62.9 percent for extension studies, 37 percent for studies that combined research and extension jointly, and 44.3 percent for all studies combined; a profitable investment by any standards but particularly so for a developing country.

A presentation by Peter McPherson, President, National Association of State Universities and Land Grant Universities of the United States, before the United States House of Representatives Committee on Foreign Affairs, Subcommittee on Africa and Global Health

References used in the complete presentation before the Committee on Foreign Affairs


Summary of Text

Today the entire world is aware that our food supply cannot meet the demands of the world population. How can that be possible? In our high tech world, we can fix every technology, visit Mars, and cure diseases. Why can’t we feed the people of the world? The answer is agricultural development. It is never complete and rarely current. About the time we think we have all the problems solved, there is a new pest or a new disease or just more people. World leaders and financial institutions tire of hearing about the problems facing farmers and food processors. Haven’t we done all that? No we have not; it is a continual process. For the last 20 years support for agriculture has not been a priority. Now it is!

Most international agencies now recognize that something must be done, but what? According to Nathaniel Don Marquez (121), Asian NGO Coalition for Agrarian Reform and Rural Development (ANGOC), many international summits and conferences have declared that there is an urgency to save agriculture from its demise. Beyond policy changes, the restructuring of global governance and institutional reforms are needed. Commitments must be translated into actions leading to a renewed interest in agriculture and a return to the basic objective of food security.

In “Egypt’s Future Depends on Agriculture and Wisdom” I describe the history and present day efforts and limitations of agricultural development in Egypt as an example of the history and results in most developing countries.

Agriculture is a major economic issue in Egypt. It is an issue as a local food source, for international trade, for balance of payments, land use and water use and as a basic product for food and fiber manufacturing. Hence every aspect of the economic structure of the country relates to agriculture. Banking, transportation, tax and tariff structure, subsidies, local and international markets and health are all part of the agricultural system of a country. Not to mention politics, of course.

Agriculture's contribution to Egypt’s GDP is gradually diminishing, but it is still an important activity. Even though only 3% of the total land area is arable land, agriculture accounted for 13.9% of GDP in fiscal 2005 and 28% of total employment in 2000/01.
For over 5000 years the farmers of Egypt created a civilization based on the union of the land and the Nile river. It was one of the earliest civilizations and it had a profound influence on the region. Agriculture created most of Egypt's wealth. Grain, vegetables, fruit, cattle, goats, pigs and fowl were grown, and fish from the Nile were caught, and eventual surpluses, after deduction of the various taxes, were sold on the markets.

One person of more recent years who lead Egypt into the modern era in the early 1800’s was Muhammad Ali Pasha. An unusual visionary who knew how to use the talent and support of his advisors, his leadership expanded Egypt's influence and its agricultural technology into the surrounding countries. (76) He learned that British textile manufacturers were willing to pay good money for cotton, Ali ordered the majority of Egyptian peasants to cultivate cotton at the exclusion of all other crops. At harvest time, Ali bought the entire crop himself, which he then sold at a mark-up to textile manufacturers. In this way, he turned the whole of Egypt's cotton production into his personal monopoly. His successor built the Suez canal and put Egypt on the road to a powerful economic unit., but there continued to be many challenges.

Continuous changes in the economy, structure, scientific basis and international standing of agriculture throughout the world had serious impacts on Egypt. By the middle of the 20th century, Egypt was faced with severely limited land and water, arid conditions, an inadequate educational system, food shortages, health problems and internal conflict. Egypt’s leaders recognized the need for help and developed cooperative projects with the support of western countries including Canada, Germany, France and the United States. Experiments of every type were tested. Many things worked and yielded improvement and many did not. It is however a story about the largest Arab country and its interactions with the western world in an attempt to improve its agricultural efficiency and hence the quality of life of its people. The events of this period provide a background for developing countries and donor countries. They are a foundation for the continued development of Egypt and the other MENA countries.

The Arab Republic of Egypt is in 2 continents, Africa and the Sinai Peninsula in Asia. It is the 15th most populous country in the world and the second most populous in Africa after Nigeria. It has one million square kilometers (386.6 square miles) of land of which less than 4% is cultivated for crop production. The 79 million people live on 40.000 square kilometers.

To discuss Egypt is to discuss the Nile. It is formed by three tributaries, the Blue Nile, the White Nile, and the Atbara. The White Nile rises from its source in Burundi, passes through Lake Victoria, and flows into southern Sudan. There, near the capital city of Khartoum, the White Nile meets up with the Blue Nile which has its source in the Ethiopian highlands, near Lake Tana.
The river then flows north through Lake Nasser, the second largest man-made lake in the world, and the Aswan Dam before splitting into two major distributaries just north of Cairo. In ancient times, the number of distributaries was much greater, but slow water flow, human interference, and the accumulation of silt had led to the disappearance of many of the distributaries. This has effectively led to the desertification of large stretches of Egyptian land.

Conflict has never been far from the banks of the Nile. Its source is in central Africa; its value to the 10 countries through which it flows and the total dependence of Egypt and Sudan on this life line have always made the political and biological life of the river a source of conflict.

In 1959 an agreement for the full utilization of the Nile water was signed between Egypt and the Sudan allocating 55.5 billion cubic meters per year for Egypt and 18.5 for the Sudan.

In Egypt 88 percent of the water is consumed in agriculture. About 96 percent of the economically active population in Egypt is engaged in agriculture and Egyptian agriculture is entirely dependent on irrigated land. Egypt’s desperate need for enormous quantities of water is therefore abundantly clear as is its need for efficient use of its limited land suitable for crop production.

**Egypt Recognizes Food Gap Problem**

By the middle of the 20th century, it became obvious that Egypt’s food supply was in serious trouble. In 1960, for example, Egypt had been almost self-sufficient in wheat production. By 1980, the country was importing about three-fourths of its wheat needs. This alarming gap due, resulted in increased attention being devoted to agriculture. The 1982 U.S. Presidential Mission on Agricultural Development in Egypt (PMADE) focused major attention on the rapidly widening food gap in Egypt, and recommended a number of specific actions to deal with the problem.

Recommendations were made for significant policy reforms that would have an impact on the problem by (1) making conditions more favorable for enhanced food production and, (2) slowing down the rate of gain in food demand. It was pointed out that cheap food, made possible by extensive government subsidies, was, in part, responsible for increasing per capita utilization by contributing to excessive waste.

In its report entitled "Strategies for Accelerating Agricultural Development" (102), PMADE addressed many policy issues. For
example, the report emphasized that government policies were acting to seriously constrain the growth of Egypt's agricultural sector and recommended that the Government of Egypt (GOE) "Permit agricultural output and input prices to move toward world price levels." The report emphasized that "correcting distortions in relative prices received and paid by farmers is central to using resources in the agricultural sector more efficiently and reducing Egypt’s growing dependence on imported food."

Major emphasis was placed on the need for strengthened research and extension programs aimed at increasing agricultural output. This recognition resulted in the initiation of a new cooperative project financed by USAID and called the National Agricultural Research Program (NARP).

National Agricultural Research Program (NARP).

In early 1994, USAID Egypt requested that Tropical Research and Development, Inc., of Gainesville, Florida, organize an assessment team of U.S. specialists to evaluate the performance and impact of the Egyptian National Agricultural Research Project (NARP) and recommend the nature of future USAID support. Their report recognized the NARP as a tremendous accomplishment.

"Egypt is in the midst of a dynamic agricultural transformation, highlighted by unprecedented yield gains and production of its major crops. For a country that has limited arable lands and water supplies and that already enjoys high crop yields, this is a tremendous accomplishment. This progress has resulted, primarily, from effective research programs and significant policy reform during the past 10- to 15-year period. Yield growth in major Egyptian crops can only be described as phenomenal over the past decade. Productivity gains for many crops have been exceptionally great since the early 1980s. Moreover, since 1981 Egypt’s agricultural performance far exceeds the average for the rest of the world in rate of gain in the indices of total agricultural production, agricultural production per capita, total food production, and food production per capita. It should be noted, as well, that with 31 of 32 major crops, Egypt exceeded world average yields. With two crops, Egyptian yields were the highest in the world. For several other crops, Egypt ranked second or third in the world in average yield.

During NARP, there was a sharp increase in production, with a distinct slowing in the rate of increase in food utilization. When projected to the year 2000, these changes show a potential food gap of some 4.5 million tons. This gap is about 17 percent of the projected gap that would have occurred in 2000 based on extrapolations of the trends in 1980.

During the assessment team’s visit to Egypt, we were asked a very pertinent question by a USAID official: "If Egypt is making all these
advances in agricultural production, why is there need to continue support for further research-related activities in agriculture. Isn’t this task now done so that we can move on to address other needs?” The simple answer to that question is that research to improve or maintain efficiency and productivity in agriculture is never done-never finished. **Today we are learning that lesson again.**

Egypt, because of its very limited arable land and water resources, is probably more dependent on research to expand food production than any other country in the world. Moreover, the primary beneficiary of such research is the consumer, who is served by having not only an adequate supply of food, but also higher quality and less expensive food as well. Therefore, the need for a high-quality, productive agricultural research program is vital to a sound economy and a stable political future. While much has been achieved through past support of agricultural research, much more effort was needed.

Following NARP and its success, the US and European institutions continued to work with Egypt on the issues identified by NARP. Progress continued in many areas, but the identification of continuing problems continue to limit productivity and supply of food.

**Cooperative Programs following NARP**

**Agricultural Technology Utilization and Transfer (ATUT)**

With the conclusion of NARP, it was clearly recognized that much of what had been done in this program needed to be continued and expanded. Research had to be expanded in the areas of horticulture and field crops. Extension and technology transfer capability was still immature and needed improvement. New varieties were needed with improved resistance to pests; tolerance to environmental stress and efficient use of water. Further it was clear that improved and expanded research in the basic sciences of genetics and biotechnology would be essential factors for such accomplishments. The project which was developed with USAID for this mission was (ATUT). It was active from 1995 to 2002. (10,14,15, 32, 45, 48, 55, 85, 91, 99) Specifically, ATUT aimed to: improve agricultural technologies in Egypt by identifying and transferring to the private sector improved horticultural production, post harvest handling and marketing technologies, by developing a carefully focused, improved collaborative strategic research program aimed at resolving the major constraints to increased productivity of selected staple crops such as rice, corn, wheat and fava bean, and by supporting the expansion of research and use of biotechnology.

ATUT was successful in improving yields in the field crops and horticultural crops. The ATUT approach was to focus the project on
upgrading production and on export sales, rather than marketing. Hence it became clear that this approach was short sighted and did not adequately address the development of systems for gathering and disseminating market intelligence and for strategic market analysis and planning.

One of the most important deficiencies, however, was the failure to recruit and train local associates for the technical team.

*Agriculture-Led Export Business (ALEB)*

ALEB was designed to provide technical assistance and support to Egyptian food processing companies, ancillary service firms, and trade associations. (8,14, 15, 33, 64)

ALEB attempted to capitalize on unexploited export marketing, particularly in the European Union and the Gulf and Middle East, and helped to develop processed food for exports and for producers who sell only domestically. This development resulted in the establishment of the Food Export Council. “The FTC will be run as a demand-driven private business in every sense of the word,” Berzi says, "with the overall objective of helping the Egyptian food industry develop into world-class exporters. We will tackle issues like accreditation, hygiene, food safety, technical assistance, testing and professional training."

*Agricultural Policy Reform Program (APRP)*

The APRP has helped the Government maintain progress on liberalizing agricultural markets and removing policy barriers to private sector participation in agriculture. The government has moved from being the major actor in all realms of economic activity to a role of providing the legal and regulatory framework necessary for the private sector and to the support of market driven trade and investment.

APRP has clearly shown that the public and private sectors need to work together as partners to take advantage of each one's distinctive competencies/capacities.

Reform progress is still incomplete in cotton, cooperatives, pesticide licensing, registration of dealers, and field supervision and research and extension. There is serious danger of back-sliding on fertilizer use and supply. The wheat sub sector, particularly the milling industry, has significant government intervention, a set of policies that seem to work at cross-purposes, and an overcapacity problem.

Serious concerns persist about the local capacity to do applied policy research and extension. Such work continues to be heavily dependent upon expatriate-led technical assistance teams. No consensus emerged on how to lessen this dependence and develop sustainable local capacity.

*Agribusiness linkages for Egypt (Aglink)*
Ag Link was a 7 year initiative which made an impressive contribution to transforming and strengthening the Egyptian livestock sector. It increased the quality and availability of milk and meat for local consumption, created a substantial rural employment base and stimulated trade linkages with the US. Aglink was awarded first place ranking for three consecutive years by Price, Waterhouse Cooper based on the number of recommendations adopted, services delivered and trade linkages facilitated.

Aglink increased the productivity, efficiency and sustainability of large commercial, medium and smallholder clients by providing technical assistance and training in basic technologies such as animal nutrition, health and farm management, trade development, association development and facilitating access to credit.

However, deficiencies in the system of collecting and disseminating market information to farmers, producer associations, cooperatives, and industry associations remain and there is a continued need assistance in the basics of association management. A lack of credit is a major limitation for all aspects of the animal industry.

**Agricultural Exports and Rural Income (AERI)**
This program worked to provide flexible and appropriate technical assistance and grants to support agriculture trade associations that are of critical importance for expanding volumes of high quality agriculture products (dairy and fresh or processed horticulture) for export and the domestic market.

Agricultural Exports and Rural Income through the small horticultural activity trained about 6,119 small and medium sized growers.

**Egyptian Research for Agriculture Today**

At the beginning of the 20th century the Ministry of Agriculture (MALR) proceeded with the established technical divisions with research capabilities. These endeavors culminated in the creation of the Agricultural Research Center (ARC) in the early 1970s. (5) Over the past two decades, numerous achievements have been realized, including the development of new varieties, improved agronomic practices, livestock development, maintenance of the national herds and better food processing techniques. New crops and animal breeds have been introduced and research has been dedicated to problem-solving, side by side with basic science. The overarching goal has been to maximize the economic return per unit of land and water.
There is one topic that is an important consideration in every type of research affecting plants, animals, and microorganisms. That topic is biotechnology or genetic engineering or molecular biology. Whatever specific term one uses, it is a powerful tool for the modification of the genetics of an organism. It is an extremely important method of reducing pesticide overuse; it is a means of accelerating the development of new strains of beneficial microorganisms as well as plants and animals. However the almost miraculous benefits of the method bring with it the problem of misunderstanding and rejection. They also bring with it the question of the use of patents; another important issue in the development and marketing of new varieties.

**Soil and Water Research**

The search for ways to achieve sustainable agriculture and natural resource management requires changes in the traditional approach to problem solving. Researchers must cross the boundaries of their individual disciplines; they must broaden their perspective to see the merits of indigenous knowledge; and they must look to the farmer for help in defining a practical context for research. This change in vision is under way in various degrees throughout the research community, but the pace of change is slow. (143)

Two key indicators of deterioration in agricultural systems are declines in the quality of the soil and of the water. Poor management of either of these resources quickly leads to decreases in farm productivity.

However the lack of any emphasis on extension of the resulting information continues to be the major problem for Egypt and the region associated with the use of the Nile waters.

**Cotton Research**

Cotton research has for over 20 years only maintained yields. Yields have not surpassed the levels of the early 1980s. The rest of the world has experienced steady increases in cotton yields. To catch up with the current Israeli level of cotton production is not possible with a business-as-usual approach to cotton research. Considerably greater focus and expenditure are needed. The present research system has been effective in maintaining yields in the face of the usual forces tending to reduce them. It must now focus additionally on what is needed for rapid yield increase.

It often appears that the decisions and regulations of the government interfere with the success of the cotton industry more than does the lack of research and extension.

Hegazy stressed the need to use advanced technology and genetic engineering to develop more productive varieties. Six countries, namely the US, Russia, China, Pakistan, Brazil and India, were able to increase their cotton production by using advanced technology.
The most significant requirement for biotech crops is that they must satisfy a clear agronomic, environmental or social need and can bring demonstrable benefit to local farmers. The trait(s) must be tailored to local needs. Full recognition and value should be placed on locally developed and adapted germplasm during any implementation of biotech cottons. The ongoing importance of conventional breeding efforts through public or private institutions should not be lost in an era of biotechnological advances.

As of 2008, biotech cotton has not become a commercial item in Egypt, but it is being studied thoroughly and perhaps will be part of the new effort to improve the quality and productivity of cotton in Egypt.

*Crop Production Research*

The world’s demand for food is enormous. The global demand for cereal grains over a 25-year period shows that the industrialized countries account for roughly 15% of this demand while developing countries account for 85%. (Sirageldin, 144). The same is true for meat products. When it comes to roots and tubers, the demand in the most industrialized countries will account for less than 3% of production while in developing countries 85 to 95% will be used. And as new, urban lifestyles lead greater numbers of people to consume more fats and less fiber, more fast food and fewer home-cooked meals, developing countries face a double challenge – widespread hunger on the one hand and rapid increases in obesity, diabetes, cardiovascular diseases and other diet-related diseases on the other.

While this points to the ongoing importance of international trade in food, it also points to the need for a transformation in the efficiency of agriculture in developing countries if these food requirements are to be met. It is argued that increasing yields, and not increasing the cultivated areas, is the only viable option to meet the increasing demand for food at less dollar expense and less damage to and better protection of biodiversity and endangered ecosystems.

The question of whether it is possible to combine the best science and the best management for crop production by the smallholder farmer. In developing countries, the problems are compounded by poor infrastructure for transporting food to urban centers. Long distances, bad roads, and urban crowding cause spoilage of 10 to 30 percent of produce in transit.

*Horticultural Research Institute*
Horticulture has a special role. The dependence on low-cash generating commodities for agriculture cannot generate enough income for rural inhabitants. Horticultural crops can be a salvation for such a situation. Another point here is related to the dependence on cereals as the main, and probably the sole constituent of diet. Malnutrition is expected due to the lack of vitamins and other food supplements. Horticultural crops provide the necessary supplements to assure a balanced diet for a healthy population. Horticulture also offers potentials for small value-adding activities that could help in generating income for rural areas and create opportunities.

Urban and peri-urban farms already supply food to about 700 million city dwellers, one-quarter of the world’s urban population. Urban agriculture involves using small plots such as vacant lots, gardens or roof tops in the city for growing crops and even for raising small livestock or milk cows.

A comparison of recommendations from the USAID Global Horticultural Assessment Priorities with those of the Horticultural Research Institute (HRI) is generally favorable, but HRI has no priorities for marketing information and structure and it is short on the post harvest issues. HRI does show a very strong focus for education and extension and for genetic resource conservation and development.

Animal Agriculture

Animal agriculture in the developed world has become increasingly science and knowledge based and where this model has been applied there has been enormous success. To deal with the increasing consumer demand for animal protein across the globe, improvements in productivity will not be sufficient. Genetic improvement is essential, but the loss of biological diversity is a major concern.

While industrial production with the same few breeds is spreading all over the world, local breeds are becoming extinct. The loss of some 8000 breeds have been reported to the United Nations Food and Agriculture Organization (FAO), by most of its 190 member governments. More than 100 breeds were reported extinct during the past century.

Clearly, the gains from genetic selection and improvement are important and in a world with a rapidly expanding population, the benefits will be obvious and will tend to be dominant. It is equally clear that there are real concerns. One is genetic diversity. The corn disaster of the 1970’s is an example that should never be forgotten.

As Egypt looks for opportunities to expand its animal productivity and marketing opportunities in Europe, it will need to look at the pluses and minuses carefully, but wisely. The need for decisions based on scientific
knowledge and social issues is further evidence that the quality of research in Egypt is one of the most important factors in the country’s future.

Genetic Engineering Research Institute

In their continuing efforts to improve their agriculture, scientists at the Agricultural Genetic Engineering Research Institute (AGERI) in Cairo employ modern biotechnology to develop new ways to improve agricultural production.

AGERI is the primary institute responsible for managing agricultural genetic engineering research in Egypt. The Donald Danforth Plant Science Center and AGERI have recently initiated several research projects that employ biotechnology to improve Egyptian agriculture.

Egypt is fortunate in having one of the best centers of GE research in the Mediterranean region. Much of the future growth and improvement of plant and animal food production will depend on the accomplishments of this Institute.

It is important to recognize that such research is not inexpensive and hence to be effective and productive, it will need the best financial and political support possible. Political support because there are so many organizations that delight in doubting the safety and efficacy of this scientific process.

The ongoing research projects undertaken at AGERI are focused on problems facing Egyptian agriculture. The immediate objectives are to utilize cellular and molecular biology methodologies to develop and deliver transgenic elite cultivars resistant to biotic and a biotic stresses and have the potential to cause a significant impact on crop productivity, the economy and the environment.

Agricultural Economics Research Institute

The studies of AERI will focus on local and international economic changes and methods of estimating the agricultural national income as well as the potential of access to the world markets of agricultural production and to open new markets and improve the marketing information system.

Food Technology Research Institute

The FTRI is principally responsible for the methods of improving quality of food products to cope with the international measures needed for
exportation and improving processing procedures in the field of bread and bakery products, dairy products, fish and meat products as well as processed horticultural products.

It must also ensure that these methods and technologies are understood and available to the processing and export businesses.

*Summary Comments Regarding Research*

We are told repeatedly that the crisis in the World food supply is not one of production but of distribution and that the solution is political. Nevertheless, even if structural solutions improve food distribution, world population will soar from 6 billion to 10 billion, or thereabouts, by 2050. This increase in population will necessitate a vast increase in the amount of food produced. At the same time the area of useful agricultural land is shrinking and, in many cases, deteriorating in quality.

To maintain the historical gains in animal productivity, scientific knowledge through research must continue to advance. Relevant investment in agricultural research is needed throughout the world in developed and developing countries to maintain food production and to achieve agricultural sustainability.

Emerging technologies must also be nurtured and employed effectively. Genetically modified foods are currently at a stage where they could flounder or bring great benefit. Their existence is threatened as the result of perceived but, in many cases, unfounded safety considerations and the ensuing negative public response. The development of technologies can be slowed down and even lost in an incompatible social context. Genetic technologies have a bright future in agriculture as well as in medicine. With proper oversight and risk assessment they can provide great benefit in the difficult times ahead.

*Agriculture’s Role in Economics and Employment*

Agriculture is an issue as a local food source, for international trade, for balance of payments, land use and water use and as a basic product for food and fiber manufacturing. Hence every aspect of the economic structure of a country relates to agriculture. Banking, transportation, tax and tariff structure, subsidies, local and international markets and health are all part of the agricultural system of a country. Egypt is no exception. Agriculture is the country’s largest employer accounting for about 28% of the labor force and 13.9% of the GDP in 2005.
Agricultural production is intensive and yields are high, but only 3% of land is arable. In spite of land reclamation, the area under cultivation remains about constant because of urban and industrial expansion. With no land expansion and population growth, Egypt will remain one of the world’s largest food importers. Some 95% of local production is consumed domestically despite the increased emphasis on cash crops for export.

The growing population of Egypt needs employment and rapid agricultural growth results in the quickest employment growth. Agricultural growth of 5% can be achieved through increased productivity, efficiency and competitiveness and could result in about 500,000 jobs. This profound impact on employment growth requires major improvements in policy matters; however, policy constraints continue to prevent Egypt from fully realizing the comparative advantage it has in most commodity systems.

Should Egypt focus on urban or agricultural growth? It is rural and agricultural growth, not urban or industrial growth that reduces poverty and increases demand for labor. These findings are consistent with the fact that agriculture drives the demand for labor through its demand for goods and services produced in the large, labor-intensive, rural non-farm sector.

GDP growth depends largely on the ability to expand production in the tradable sectors, while employment growth depends largely on increases in (domestic) demand for non-tradables.

When agriculture grows rapidly, demand for labor grows rapidly; when urban tradables grow rapidly, GDP grows rapidly. A structure weighted towards agriculture is weighted towards benefits to labor; a structure weighted towards urban tradable items is weighted towards fast growth in GDP. Urban tradables grow primarily through increase in the capital stock. Agriculture tradables grow largely through technological change.

Treating “rural” and “urban” poverty as somehow separate and in competition with each other for resources is not only a conceptual mistake, but a remarkably short-sighted view of the problem. In fact, successful rural development generally stimulates and supports urban development. Conversely, urban growth is a powerful stimulus to food production, especially by small farmers.

The projected expansion of the urban population in Asia and Africa, from 1.7 to 3.4 billion over a period of only 30 years, and the reduced level of available resources, stress the need for a more imaginative but pragmatic response.
A Model for Feasible Growth Rates

In this discussion, **employment increase and poverty reduction** are used interchangeably because increased employment is the means by which growth reduces poverty.

The World Bank has made frequent use of an average relationship between overall growth and poverty reduction. On average a 2.1 percent decrease in poverty levels is associated with a 1 percent increase in the economic growth rate.

An analytical model for Egypt, finds that, compared with pro-manufacturing policies, pro-agricultural policies have a more positive impact on household welfare in general and the poor in particular. It also shows that improved market access for agricultural exporters and reduced transaction costs in foreign trade reinforced the effect of generally positive policies toward agriculture.

Raising farm incomes—which can be achieved through technological change and globalization—increases the demand for output and hence for labor in the massive rural non-farm sector that is home to the bulk of the poor and underemployed.

That is why agricultural growth is not only important to growth in national income, but also absolutely vital to growth in employment and reduction of poverty.

This section of the report describes the commodity composition for a high growth rate for Agriculture. Farmers make decisions about resource allocation among specific commodities. Much of investment, institution building, and policy are also commodity specific.

For all commodity groups, two inputs, water and fertilizer, are particularly important to achieve strong growth rates. Fertilizer is already used at very high rates in Egypt. Increasing the efficiency of fertilizer use will favor higher farm incomes as well as being environmentally sound. Efficiency of water use is also critical to achieve strong growth rates.

As success is achieved on export markets with non traditional crops, horticulture will become increasingly a tradable commodity with demand not constrained by the domestic market. Horticulture uses rather little land relative to its value of output. However, even though high in general, Egyptian yields lag well behind what can be achieved with current technology.

Egypt has a strong comparative advantage in extra-long staple cotton, but Egypt must focus on what is needed for rapid yield increase. The present research system has been effective in maintaining yields in the face of the usual forces tending to reduce them. It must now focus additionally on what is needed for rapid yield increase. Similar statements can be made
for other internationally traded commodities including maize, wheat and rice.

Egypt has highly productive agricultural resources that are reflected in high crop yields. Such conditions are normally highly responsive to the new opportunities offered by technological advance and the forces of globalization.

There is an implicit assumption that new lands will be allocated optimally and will be comparable in quality to past additions. It also is assumed that sufficient increase in water use efficiency will occur to meet the rapidly growing urban needs without productive loss in agriculture. These are all heroic assumptions. For them to become reality will require continuing attention to water use policy and the making of hard decisions about where new water will be allocated. In this context, difficult conflicts between the best allocation for employment and national income growth and broader national objectives will have to be resolved.

Not Achieving the Comparative Advantage

Thus, the solution to Egypt’s employment problem can be met only with major efforts in agricultural employment as well as accelerated growth of the urban, tradable goods and services sector. It is not a matter of one or the other, it is a matter of the total of both sectors.

The importance of the task is challenging and enormous. A recent statement from the Office of the Minister of Commerce and Industry of Egypt in July of 2007 estimated that one million new jobs are needed in Egypt each year.

Horticulture could be the Future

Egypt enjoys a significant comparative advantage in the production and export of high value horticultural products. This comparative advantage is based on a number of factors, including favorable agro-climatic conditions, physical proximity to important markets and counter-seasonal production capabilities. The growth in industry cohesiveness and sophistication and an increasing awareness on the part of government toward the importance of private sector primacy in decision-making are also important factors.

However, education, research and extension systems do not meet the needs of the horticultural industries. The governmental processes need to be more positive; There is a lack of adequate market intelligence, and agricultural leaders must take responsibility for major issues.
The initial competitive advantage of production and sales will not be maintained without explicit efforts to do so. Market prices are declining both absolutely and in relation to Egyptian prices. Egypt will have to reduce the delivered cost of its products to remain competitive. This will have to be accomplished through the adoption of new technologies. These include inadequate post harvest facilities, costly transportation, need for approval of varieties and pesticides, tariffs and sales taxes, high commercial financing, and inadequate technical and management skills.

The farming practices employed for Egypt’s principal horticultural crops, grown by hundreds of thousands of small and medium-sized holders principally for domestic demand, can be improved and thereby increase rural income. Costs can be reduced, yields increased, and quality improved through the introduction of even low-technology, low-cost techniques. This has not been accomplished because of a lack of well trained horticulture extension advisers. It is also essential that there is a broad base of cooperation with all government entities involved in the export sector, including the Ministry of Foreign Trade (see food council) and the Ministry of Transportation.

One of the most urgent of these specific problems is the impending imposition of the EUROGAP protocol being promulgated by major European retailers. This embodies food quality assurance measures combined with social and environmental responsibility standards. Failure to meet those standards will deny Egyptian horticultural products access to current European markets and will prevent entry into new EU markets.

While the focus is on exports, the Egyptian horticulture industry should not lose sight of the fact that there is also a growing demand for higher quality foodstuffs in the domestic market, led by five-star hotels, up-market restaurants, fast food chains and an increasing number of supermarkets.

Food Export Council

New activity in the food processing industry fueled record industrial growth of 5.1% last year as companies tapped lucrative Gulf and European markets. Members of the new Food Export Council are convinced they can grow last year’s $500 million in exports to $3-4 billion within a decade.

Quality control has never been Egypt’s forte, to say the least. Across all sectors, industry’s failure to meet international quality standards has been one of the biggest obstacles to the penetration of foreign markets. Last year, the Ministry of Foreign Trade and Industry began overhauling its existing centers and establishing new ones. There are now a total of 13, ten of them sectoral and three cutting across industry lines for packaging,
clean production and total productivity management. All of them are adopting proactive, client-centered business models.

According to Tawfik, head of the Food Export Council, the processed food sector has the capacity to export something in the range of $3-4 billion per year, an ambitious goal in light of today’s $500 million figure. But he and others on the export council are convinced they can make it happen.” Tawfik says. “Everyone has to carry his own weight — we can’t always have to look to the government to bail us out.
PART ONE
HISTORY OF AGRICULTURE IN EGYPT

Although there were reports of agricultural development as early as the Pleistocene period, it is clear that Egypt has enjoyed a strong agricultural economy for the past 5000 years. Modernization of the food and fiber system was given a push by Muhammad Ali in the 1800’s.
For over 5000 years the farmers of Egypt created a civilization based on the union of the land and the Nile river. It was one of the earliest civilizations and it had a profound influence on the region. Today agriculture in Egypt combines the use of traditional methods with a rich base of knowledge of the land and the environment. A professor of horticulture at Purdue University and a colleague of mine, Dr. Jules Janick (49), provides this description of agriculture in ancient Egypt.

"Ancient Egypt and Natural river irrigation shaped the early landscape of ancient Egypt. Drainage was not required for the Valley to become livable. It may have constituted a problem in the lower lying parts of the Delta which were often marshy. With the natural flooding and draining of the floodplain the annual inundation permitted a single crop-season over two-thirds of the alluvial ground.

Organized by regional authorities, every Egyptian had to move about thirty cubic metres of soil in about ten days every year. With this relatively small investment of labour, they kept the system in working order. Once the main canals, many of them natural, were in place, they just had to be dredged yearly to prevent their clogging up; the levees had to be raised, and smaller ditches had to be re-excavated.

The building of dams at right angles to the flow of the Nile, separating the Nile Valley into basins, precedes the Old Kingdom. Dikes were built along the banks of the river and the basins which covered between 400 and 1700 hectares, were carefully levelled. The river water was diverted into canals on either side of the Nile. At the time of the highest flooding
(towards the end of September) most of the Nile Valley was covered with water, only villages and cities, built on higher ground and connected by dams, were above water. When the water level reached the mouths of the canals, the dams separating the canals from the river were opened and the basins and canals flooded. When the highest water level was reached, one to two metres above the ground, the canals were stopped and the water left standing until it evaporated or was drained off during the next two months. The waterlogged earth did not need much further irrigation. The boundaries of the fields were marked with boundary stones. These had to be replaced frequently after the inundation, based on cadastral records.

The building of dams and canals was done at local or regional levels, and while in the past many held irrigation to be the prime cause for the emergence of a central government, most think nowadays that the involvement of the national government in the irrigation was probably minimal: the opening and closing of the canal sluices to Lake Moeris in the Fayum in order to regulate the flow of the river must have been a task for the central authorities.

In most countries heavy ploughs have to be used to turn over the soil, so that the growing plants get enough nutrients, but in Egypt the Nile flood deposited the nutrients on top, and the ploughing served just to break up the top soil before sowing or for covering the seed. The Egyptian plough was lightly built and tied to the horns of the cattle. Cows were generally used for ploughing, which caused their milk production to decrease during ploughing time. A helper, often a child, led the animals, sometimes urging them on with a stick. When draft animals were unavailable, humans would pull the plow.

Hoeing was another way of loosening the soil. Because the handles of the hoes were very short (a feature of these tools even today in southern countries), this was back-breaking work. The sower walked back and forth over the still moist field, a bag in one hand and spreading the seed with the other, or having a two handled woven basket tied around his neck, both his hands free for sowing. Sometimes a plough covered the seeds with earth. Driving hogs or sheep over the field served the same purpose.

Crops Harvested

The total amount of grain harvested depended on the surface covered by the flooding Nile, which was between perhaps 20,000 and 34,000 square kilometers. Taking pre-green-revolution wheat yields of about 750 kg/ha as a base, the annual amount of corn produced was approximately between 1.5 and 2.5 million tons, supposing that most of the surface was used to produce corn. About 4 to 5 million people lived in Egypt during the New Kingdom. In a bad year the annual yield was less than 300 kg per head, possibly considerably less.
Occurrences of corn dearth were frequent. Some estimate that there would have been sufficient grain only every third year. This may be a bit pessimistic. At any rate, Egypt seems to have had grain surpluses often enough that they could be stored in state granaries and even be exported. During Roman times it was one of the bread baskets of Rome.

The harvest generally took place shortly before the beginning of the next flooding, about in May or June, at times in April. The whole population took part and on big estates journeying harvesting teams were employed. These itinerant reapers began the season in the southern part of the country and followed the ripening crops downriver. The Egyptians seemingly knew ergot which does not proliferate well under the dry Egyptian weather conditions and was probably never the health danger it was to be in the rye eating countries of northern Europe during the late Middle Ages.

The administration was involved in everything the farmer did, from the assignment of the land to the collecting of the taxes. Before the harvest began, surveyors, scribes, supervisors and inspectors came to measured the size of the fields and estimated the quantity of grain. These officials fixed the tax the peasant had to give up to the royal treasury or the representative of one of the gods, among whom Amen had the vastest and best properties. Scribes trying to impress their pupils with the harshness of a peasant’s daily struggle for survival, may have slightly exaggerated the methods used by tax-collectors, but Egyptian officials were not noted for sparing the rod (nor have peasants ever shown an alacrity to part with the fruit of their labor).

Low inundations were the main reason for bad harvests and they affected the whole of the country. But there were no end of causes for low yields, from the failure of the local administration to care for the upkeep of canals and dykes, to the destruction of the harvest by pests and raids of thieves. Corn that was not destined for immediate consumption was stored in communal granaries, which served as a kind of bank.

Important crops were emmer (Triticum dicoccum) which stopped being grown by the Roman period, barley (Hordeum hexastichon), used for baking bread and brewing beer, the significance of which declined during the Roman Period when wine replaced beer to a large extent, wheat (Triticum aestivum), an unidentified sort of cereal, flax (Linum usitatissimum) for the production of cloth and ropes, the naturally occurring papyrus reeds (which became extinct in Egypt and were recently reintroduced), used for paper, boats, ropes, mats and many other things and the castor oil plant (Ricinus communis), from the fruit of which oil for many purposes (among others as a sort of money) was pressed.

Domesticated in Mesopotamia, the opium poppy (Papaver somniferum L.) may have been grown on a commercial scale near Thebes during the New Kingdom, and opium thebaicum was possibly traded by Phoenicians
to southern Europe, the Levant and North Africa. Jewelry and small, perhaps foreign, containers looking somewhat like poppy-heads dating to the 18th dynasty have been found, but few - if any - traces of the plant itself or its products. Oil was extracted from poppy seeds in the Fayum during the third century BCE. Some scholars think that the production of opium for medicinal purposes was introduced into Egypt only in Roman times.

Horticulture

Gardening was much more labor intensive than agriculture. Gardens, orchards, and vineyards were often on high ground and quite a distance from the Nile. They had to be irrigated by hand with the water drawn from wells or the river. Moreover, in the absence of the depositions of silt with which the Nile revitalized the inundated areas, the soil of the higher lying ground needed fertilizing. During the Roman era at least, farmers at Karanis in the Faiyum kept pigeons in dovecotes and used their dung to fertilize the soil. Pliny thought that growing conditions in Egypt were especially favorable to the horticulturist. He claimed that in Egypt the leguminous plants appear as early as the third day after they are sown. Gardeners grew radishes, sesame, lentils, beans and chickpeas (Cicer arietinum), lettuce, onions, leeks, dill (Anethum graveolens), grapes, melons, cucumbers and gourds. Many Egyptians had gardens adjacent to their homes where they grew small quantities of vegetables and fruit for their own consumption.

Bee-keeping

The first official mention of honey production dates to about 2400 BCE, in official lists of apiarists; the oldest pictures of bee-keepers are found in New Kingdom tombs. The kind of hives depicted in these reliefs, woven baskets covered with clay, are still seen in the Sudan today. Cylindrical hives were made of clay.

The main centre of bee-keeping was Lower Egypt with its extensive cultivated lands, where the bee was chosen as a symbol for the country. One of Pharaoh’s titles was Bee King, and the gods also were associated with the bee. The sanctuary in which Osiris was worshiped was the Mansion of the Bee. But even nomadic Upper Egyptians probably kept bees, as their use of honey in the production of green eye paint indicates. There were itinerant apiarists in the Faiyum in Ptolemaic times and possibly also beekeepers living by the Nile who loaded their hives onto boats, shipped them upriver in early spring, and then followed the flowering of the plants northwards as they were reported to do in the 19th century CE.
The Egyptians seem to have valued wild honey even more. Honey hunters, often protected by royal archers, would scour the wild wadis for bee colonies.

Honey Temples kept bees in order to satisfy the desire of the gods for honey and for the production of medicines and ointments. But demand far outran local production. Honey, like many other luxury goods was imported from Djahi or Retenu (north of Jerusalem) and possibly even further afield. Canaan, for instance, was called Land of Milk and Honey in the Hebrew tradition, and the probably fictitious Sinuhe waxed lyrical about the riches of Yaa, an unidentified Asiatic region.

**Farmed and Domesticated Animals**

Sheep, goats, cattle, pigs and geese were raised from earliest times and supplied milk, wool, meat, eggs, leather, skins, horn and fat. Even the dung had its uses. There is little evidence that mutton was consumed, while domesticated pigs were eaten at least since the beginning of the 4th millennium BCE, but pork had no place in religious ceremonies. Goat meat on the other hand was acceptable even to upper class Egyptians. Goat skins served as water containers and floating devices.

The Egyptian farmers, in their early experimental phase, also tried to domesticate other animals such as hyenas, gazelles and cranes, but abandoned these attempts after the Old Kingdom. The domestic chicken didn't make its appearance until the New Kingdom, and then only in isolated places. It became more common in the Late Period. By then the Egyptians seem to have mastered artificial incubation.

On the whole the ancient Egyptians seem to have been accomplished farmers, and they were certainly lucky with their system of irrigation which prevented the salinization of the soil. Other cultures relying on artificial irrigation suffered from. Diodorus Siculus, a Roman historian writing during the first century BCE, had a high opinion of the agricultural expertise of the Egyptians.

**Economics of Pharonic Egypt**

The economy of Pharonic Egypt has been called an ancient command economy, but one should always remember that such modern definitions are not as absolute as they might be today. Still, there was a specialized bureaucracy which monitored or controlled much of its activity, one of the hallmarks of planned economies. On the other hand, the officials - as state employees and not as private landowners or managers of state farms - probably did not tell farmers what to grow. But they remeasured and reassigned the land after every inundation - based on past assignments, assessed the expected crops, collected part of the produce as taxes, stored and redistributed it. Storage and redistribution were generally done on a local basis. Regional facilities provided produce in
case there was a shortfall in one of the local centers. Bureaucrats were also in charge of public works which were mostly religious in character and involved at times tens of thousands of workers and administrators.

The Population
The vast majority of the population, probably more than nine tenths during the first two millennia of Egypt's history, lived on the land in mostly autarkic village communities and, in early times at least, in a state close to serfdom. The land they worked belonged in theory to the gods, Osiris and after his demise to Horus and his earthly incarnation, the pharaoh. In practice a virtual ownership evolved, a development which culminated in the Late Period, when land could be freely bought and sold. Apart from the tenant peasants, a large section of the population worked as farm laborers on the estates of noblemen and of the temples. During the New Kingdom perhaps a third of the land was in the hands of the Amen priesthood, with a proportionally large number of workers and slaves. Administrators, priests, traders and craftsmen lived mostly in the cities along the Nile, which could be supplied with victuals relatively easily and cheaply by boat.

Sources of Wealth
Agriculture created most of Egypt's wealth. Grain, vegetables, fruit, cattle, goats, pigs and fowl were grown, and fish from the Nile were caught, and eventual surpluses, after deduction of the various taxes, were sold on the markets.

Thanks to the yearly inundations the soil remained fertile. But agricultural techniques were not very efficient. Improvements were rare, implements remained primitive and the breeding of better livestock was haphazard. Fishing appears to have existed on a very small scale. But practically all the fish consumed were caught in the Nile. Hunting, a leisure activity to the rich, and gathering played a small economic role over all, but may have been crucial to the survival of the poorest.

Manufacturing
A large part of the manufactured goods came from the families which produced the raw materials. Labor was divided according to gender, with the processing generally left to the women. While the men grew flax, their women spun it into thread and wove the linen. A sizable proportion of the grain produced was used for beer production. The fish caught by the men had to be cleaned and dried by the women to be of much use in the hot climate of Egypt. In the towns small factories appeared, often financed by rich noblemen: bakeries, breweries, carpentry workshops and the like with a few dozen employees. In these manufactories weaving, for
instance, became a largely male occupation with the introduction of upright looms during the New Kingdom.

**Mining**

Most of the things mined were of little interest to anyone but a small number of rich people. Precious metals were not in general circulation until the Late Period and even then remained in the hands of few. The metals used for tools - copper, bronze and, from the Late Period onwards, iron - were expensive and the implements fashioned from them were beyond the reach of many. Poorer people continued to use stone and wooden tools for most purposes well into the bronze and even iron age. Gems too remained in the possession of a wealthy minority and the stone quarried for temples and tombs served the same class of people and profited only the craftsmen involved in building. Natron needed for the embalming process, was mined in the Wadi Natrun. Embalming was too expensive for all but a few.

**Commerce and banking**

Most of the produce was consumed by the producers themselves. What was left after landlords and tax-collectors had taken their share, could be sold by barter on the free market either directly to consumers or to professional traders. Little is known about these merchants. It is generally assumed that they were, at least until the Late Period, for the most part agents of the crown or the great estates. Some of the wheat harvested and belonging to private owners was stored in state warehouses. So was much of the grain collected as taxes. Written withdrawal orders by owners of lots of grain were used as a kind of currency. These grain banks continued to serve growers and traders even after the introduction of coined money. Under the Ptolemies a central bank at Alexandria recorded all accounts of the granary banks dotting the country. Payments were transferred from account to account similar to the modern giro system. Credit entries were recorded with the owners name being in the genitive or possessive case and debit entries in the dative case.

Since the second half of the first millennium BCE gold, silver, and copper in specie were used mostly in dealings with foreigners, be they mercenaries or merchants. High interest rates did not encourage commerce and during the first millennium BCE they may well have put Egyptian merchants at a disadvantage vis-à-vis foreign traders who were funded from abroad. During the Saite Period monthly interest rates could reach 10%.

**Energy**

The main energy source of ancient times was muscle power provided to a large extent by humans. The harnessing of animals was inefficient. The
yoke resting on the animals' shoulders was unknown, and the shafts of the ploughs were fastened to the horns of the cows.

Vehicles with light spoked wheels came into use during the New Kingdom and served mostly for warfare and sport. Horses were introduced during the Second Intermediary Period and never achieved economic importance. Anything transported by land, even in arid desert regions, was either carried by humans or donkeys, or dragged on wooden sledges.

Wind energy was exploited only by ships and even there quite inefficiently: The square sails used enabled only sailing before the wind. The Egyptians were fortunate in that the Nile flowed from south to north. The prevailing winds were northerly and sufficed to blow the ships upriver. They were let to drift downriver with furled sails. But often a destination could only be reached through rowing which required large crews.

Fire was needed for cooking and baking food, smelting and casting metal, burning pottery and very rarely for making bricks. For the working of metals high temperatures had to be achieved and this was done quite possibly with charcoal. No coal was available in ancient times and wood was not very plentiful. One suspects that ordinary fires were fed with any dry vegetable or animal matter that was at hand. The heat of the sun on the other hand was put to very good use in the production of mud bricks, which were the perfect building material in a practically rainless country like Egypt.

**Warfare**

Military ventures can be a source of income - as long as one is successful. Egypt was fortunate in this respect until the Late Period, when it came under the domination of foreign powers. What began with relatively benign occupations by the Libyans, Kushites, Assyrians and Persians, became oppressive under the Roman Empire, which exploited its provinces ruthlessly. The attempts of Cleopatra VII to retain independence were unsuccessful and the country fell prey to Octavian. For as long as Rome ruled the Mediterranean, Egypt was little more than its bread basket.

Unlike the much vaunted empire of the New Kingdom, which was mostly a string of subject states in Lower Retenu run by local potentates, the real and lasting conquests lay in the south, in Nubia and Kush. Nubia at least was directly ruled and exploited by the Egyptians. Its importance as supplier of gold, slaves and luxury goods is underlined by the appointment of vice-roys. No other region conquered by Egypt was as closely integrated economically and culturally and retained this affinity for centuries after Egypt's power had declined in the first millennium BCE.
Bravery in battle was rewarded with appointments, decorations in the form of golden necklaces and bracelets, and gifts of land and slaves, part of the booty plundered from vanquished enemies. Tribute was imposed on defeated nations and the 'exchange' of gifts between the pharaohs and the kings of client states was generally in Egypt's favor.

**Slavery**

The practice of slavery was practically ubiquitous in ancient times. In Egypt it was seemingly less harsh and widespread than in other societies. Still, some branches of the economy like mining depended to some extent on the labor and expendability of slaves, above all during the New Kingdom, when warfare and trade greatly increased the number of enslaved foreigners.

**Taxation**

Ancient Egypt is considered by some to have been the most heavily taxed nation and to have collapsed under the weight of the levies imposed on the populace. But, with a few minor interruptions, its society existed peacefully and basically unchanged for more than two millennia. The state relied on revenues in the forms of labor and taxes paid in kind. A major part of the levies imposed on the people was used to stabilize society. A bureaucratic administration, at first native and in the Late Period increasingly foreign, enforced order throughout the country during most of its history. Three millennia of mainly quiet development point to the success of this policy: Grain was stored which could be distributed in times of famine. Corvée workers were fed from these stores during the months of inundation when work in the fields was impossible. Artisans constructing public buildings found employment, paid by the royal treasury. Even the offerings at the temples were at least partially used to feed the poor. Of course, different classes of people benefited to different degrees, but care was taken not to leave too many people with nothing to lose, a lesson the Spartans and the Romans for instance never learned. While famines affected the poor much more than the rich, in normal times there was not that much difference as regards health, survival of ones children or even longevity.

In a society where precious metals were not considered a special means of exchange and were mostly in the hands of the pharaohs and the temples, wealth was synonymous with possession of land. Theoretically all the land belonged to the pharaoh who could dispose of it at will. Large tracts were given to the military, above all during times of unrest when the kings needed their support and were unable to recompense them in any other way. Officials were also beneficiaries of such royal munificence. But most of the land came to be owned outright by the temples and the peasantry.
A considerable amount of wealth was invested in the building of tombs and the services following burial, which were supposed to go on for ever. The gods had to be propitiated by offerings and rituals celebrated by great numbers of priests. To maintain this clerical establishment large parts of Egypt were donated to the temples. By the New Kingdom they appear to have owned as much as a third of the arable land and were exempt from paying taxes. Even the people in their employment were protected by law against impressments. This concentration of wealth may have contributed to the decline of the state under the 20th dynasty.

**Ancient Trade Routes**

(89) “Rediscover Ancient Egypt with Tehuti Research Foundation”

www.egypt-tehuti.org

Superficially, Ancient Egypt seems isolated and distinct from the rest of the world, isolated by the deserts that hem in the narrow valley of the Nile. Yet the Egyptians were in constant contact with other countries. The needs of a civilized society, such as the Ancient Egyptians, are not fully satisfied with the produce of its homeland. Thus, trade routes were developed to faraway places. The Nile was navigable throughout the length of Egypt. The Red Sea gave access to Africa and the Far East. The Mediterranean Sea gave them access to countries in Europe and even to northern Europe and the Americas. Travel in ancient days was much more extensive and common than is generally imagined.

**Egypt was connected with the lands to the south by three main routes:**

The Forty Days’ Road links Asyut in the Nile Valley to El Fasher in the Dar-Fur Province of Sudan, a journey of 1,082 miles (1,721 km). It was the shortest and safest distance to travel into western Africa. From El Fasher, another route led west through Dar-Fur, toward Lake Chad, ending in the area of Kano (northern Nigeria), at the upper reaches of the Niger River Basin. It began at Sunt (Aswan), and went to El Fasher in Dar-Fur, by way of the oases of Selima and Bir Natrum. Sunt (Elephantine) Road also branched off to Semna West, where the caravans and expeditions transferred to ships in order to continue the journey to beyond the trading post established at Kerma, above the Third Cataract. During the time of the New Kingdom (1550-1070 BCE), this highway was in continuous use all the way throughout the Roman Era, as many inscriptions on the Rock of Offerings at Sunt(Elephantine) testify.

There were also several trade routes to the Red Sea from the Nile Valley, which allowed trade with Asian countries. Some of these ports along the Red Sea were: Suakin, Massawa, and Zeila. The whole African continent
was known to the people of Egypt, as confirmed by Herodotus, who reported that Necho, King of Egypt, c. 600 BCE, sent an Egyptian ship with Phoenician sailors to circumnavigate Africa, and that they returned safely and reported of their endeavor.
CHAPTER 2
THE PERIOD OF MUHAMMED ALI

One person among the many who have lead Egypt through its 5000 hears of history is Muhammad Ali Pasha. An unusual visionary who new how to use the talent and advice of his advisors, his leadership expanded Egypt's influence and its agricultural technology into the surrounding countries. (76)

The Founder of Modern Egypt
Muhammad Ali Pasha (Arabic: محمد علي باشا) or Mehmet Ali Paşa (Kavalalı Mehmet Ali Pasha in Turkish) (c. 1769 - August 2, 1848), was a viceroy of Egypt and is often cited as the founder of modern Egypt. Muhammad Ali was born in the town of Kavala (in present day Greece)
in an Albanian family. After working for a time in his youth as a tobacco merchant, Muhammad Ali took a commission in the Ottoman army. Ali spent the first years of his rule fighting off attempts to unseat him and extended his personal authority over all of Egypt. In one of the most infamous episodes of his reign, Ali definitively broke the power of the Mamluks by massacring their leaders. Having worn down the Mamluks for years with raids and skirmishes, he invited their amis in 1811 to a feast to celebrate his son Tosu Paşa’s appointment to lead the army being sent against the Wahhabi rebellion in Arabia. As the procession of Mamluk princes made its way through a narrow gated alley in the Citadel, Ali’s men shut the gates, trapping all the Mamluks and his rival Kadeem, as the soldiers positioned in the buildings facing the alley opened fire from above. When the shooting ended, soldiers on the ground finished off any Mamluks still living with swords and axes. In the following days, he ordered his men to kill any other Mamluks they could catch.

**Industrialization and modernization**

The reign of Muhammad Ali and his successors over Egypt was a period of rapid reform and modernization that led to Egypt becoming one of the most developed states outside of Europe. It also led to massive government expenditures, that ended up bankrupting Egypt and eventually led to it falling under control of the United Kingdom of Great Britain and Ireland.

Muhammad Ali executed one of the greatest land grabbing in history. He confiscated the feudal farms of the Mameluk grandees and stripped Cairo’s religious institutions of their 600,000 prime acres of landholdings. Thus decapitating Cairo’s medieval order and Egypt was now the viceroy’s private plantation. With the help of the French, Mohammed Ali set about making changes. He ordered wide-scale planting of a new strain of cotton, which was to be the cash crop that would finance the economic revival. Since British textile manufacturers were willing to pay good money for such cotton, Ali ordered the majority of Egyptian peasants to cultivate cotton at the exclusion of all other crops. At harvest time, Ali bought the entire crop himself, which he then sold at a mark-up to textile manufacturers. In this way, he turned the whole of Egypt's cotton production into his personal monopoly. He also experimented with textile factories that might process cotton into cloth within Egypt, but these did not prove very successful.

He created state monopolies over the chief products of the country. He set up a number of factories and began digging in 1819 a new canal to Alexandria, called the Mahmudiya (after the reigning sultan of Turkey). The old canal had long fallen into decay, and the necessity of a safe
channel between Alexandria and the Nile was much felt. The conclusion in 1838 of a commercial treaty with Turkey, negotiated by Sir Henry Bulwer (Lord Darling), struck a deathblow to the system of monopolies, though the application of the treaty to Egypt was delayed for some years.

Efforts were made to promote education and the study of medicine. To European merchants, on whom he was dependent for the sale of his exports, Muhammad Ali showed much favor, and under his influence the port of Alexandria again rose into importance. It was also under Mehemet Ali's encouragement that the overland transit of goods from Europe to India via Egypt was resumed.

The needs of the military likewise fueled other modernization projects, such as state educational institutions, a teaching hospital, roads and canals, factories to turn out uniforms and munitions, and a shipbuilding foundry at Alexandria, although all the wood for ships had to be imported from abroad. In the same way that he conscripted peasants to serve in the army, he frequently drafted peasants into labor corvées for his factories and industrial projects. The peasantry objected to these conscriptions and many ran away from their villages to avoid being taken, sometimes fleeing as far away as Syria. A number of them maimed themselves so as to be unsuitable for combat: common ways of self-maiming were blinding an eye with rat poison and cutting off a finger of the right hand, which usually worked the firing mechanism of a rifle.

He died in August 2, 1849. He had done a great work in Egypt; the most permanent being the weakening of the tie binding the country to Turkey, the starting of the great cotton industry, the recognition of the advantages of European science, and the conquest of the Sudan.

**Muhammad Ali's Successors**

On Ibrahim's death in November 1848 the government of Egypt fell to his nephew Abbas I, the son of Tusun Abbasad. Abbas put an end to the system of commercial monopolies, and during his reign the railway from Alexandria to Cairo was begun at the instigation of the British government. Opposed to European ways, Abbas lived in great seclusion. After a reign of less than six years he was murdered in July 1854 by two of his slaves.

He was succeeded by his uncle Said Pasha, the favorite son of Mehemet Ali, who lacked the strength of mind or physical health needed to execute the beneficent projects which he conceived. His endeavour, for instance, to put a stop to the slave raiding which devastated the Sudan was wholly ineffectual. He had a genuine regard for the welfare of the *fellahin*, and a land law of 1858 secured for them an acknowledgment of freehold as against the crown.
The pasha was much under French influence, and in 1854 was induced to grant to the French engineer Ferdinand de Lesseps a concession for the construction of the Suez Canal. Lord Palmerston was opposed to this project, and the British opposition delayed the ratification of the concession by the Porte for two years. To the British, Said also made concessions to the Eastern Telegraph Company and another in 1854 allowing the establishment of the Bank of Egypt. He also began the national debt by borrowing 3,293,000 from Messrs Fruhling & Gbschen, the actual amount received by the pasha being 2,640,000. In January 1863 Said Pasha died and was succeeded by his nephew Ismail, a son of Ibrahim Pasha.

**The Suez Canal**

The reign of his son Ismail, from 1863 to 1879, was for a while hailed as a new era into modern Egypt. He attempted vast schemes of reform, but these coupled with his personal extravagance led to bankruptcy, and the later part of his reign is historically important simply for its compelling European intervention in the internal affairs of Egypt. Ismail re-established and improved Mehemet Ali’s administrative system, which had fallen into decay under Abbas’s uneventful rule; he caused a thorough remodeling of the customs system, which was in an anarchic state, to be made by English officials; in 1865 he established the Egyptian post office; he reorganized the military schools of his grandfather, and gave some support to the cause of education. Railways, telegraphs, lighthouses, the harbour works at Suez, the breakwater at Alexandria, were carried out by some of the best contractors of Europe. Most important of all, the Suez Canal was opened in 1869.

**The American Civil War Helps**

Early in Ismail’s reign Egypt took advantage of vastly inflated cotton prices, caused by the American Civil War. Once that conflict ended Ismail had to find new sources of funding to keep his reform efforts alive. Thus the funds required for these public works, as well as the actual labor, were remorselessly extorted from a poverty-stricken population. (76)
PART TWO
EGYPT TODAY

It is essential to have a basic understanding of the economy, structure, education and natural resources before we begin planning to improve the agricultural productivity of modern day agriculture. Probably the most important natural resource any country could desire is water. The Nile river and Egypt are practically synonymous. The Nile is however politically and structurally fragile.
Most people know about the pyramids and the Nile river and the major cities of Cairo and Alexandria. The more dedicated visitors know about Luxor and the valley of the kings. Perhaps others can find Sharm el Sheik and the Aswan dam on a map of the country. Egypt is surrounded by Israel and the Red sea on the east, Sudan on the south, Libya on the west and the Mediterranean sea on the north.

It has one million square kilometers (386.6 square miles) of land of which less than 4% is cultivated for crop production.

It is a country in North Africa officially known as the Arab Republic of Egypt and includes the Sinai Peninsula which is located in Asia. It is the 15th most populous country in the world and the second most populous in Africa after Nigeria. The 79 million people live on 40,000 square kilometers.

**Constitution, Institutions and Administration**

The 1971 constitution provides for the separation of powers between the executive, the legislature and the judiciary. Islamic law is officially the principal source of legislation, but the Napoleonic Code is a more significant progenitor. The president, the head of state, has executive authority, including the ability to veto legislation, and enjoys vast powers of patronage. Presidential appointees include the vice-presidents, the prime minister and ministers, provincial governors, armed forces and
security heads, major religious figures and High Court judges. The president is also supreme commander of the armed forces.

The president was previously nominated by a two-thirds majority of the Majlis al Shaab (People's Assembly) and elected by referendum. Following an amendment to the constitution, in September 2005 the president was for the first time elected by universal suffrage. Candidates fielded by legal parties are eligible if the parties are five years old and hold 5% of the seats in parliament, whereas independent candidates must win backing from 250 elected politicians drawn from the People's Assembly, the Shura Council (advisory chamber) and provincial councils. The stipulation was contentious since the NDP holds almost all the seats in the Shura Council (a mainly ineffective 264-member consultative body) and local councils and overwhelmingly dominates the People's Assembly.

**The People's Assembly**

The People's Assembly, which comprises 444 directly elected members, exercises legislative power. One-half of the assembly are in theory farmers and labourers, but in practice this is not observed, and ten members are nominated by the president. Presidential decrees also have the force of law. The president may dissolve the Assembly only if he gains support for such a course in a referendum, and a minister can be required to resign if the Assembly passes a vote of no confidence in him. Should that happen against the president's wishes, the matter may be put to a referendum. The ruling NDP emerged from the October-November 2000 parliamentary election with its usual commanding majority, but only after elected independents rejoined the party following the poll. The election was the first under full judicial supervision, allowing a more diverse outcome than usual, but allegations of malfeasance persisted. In any case, the Assembly's ability to change the government or to amend legislation remains severely limited.

The president appoints one-third of the members of the Shura Council; one-half of its elected members face election every three years and all members sit for six years. Elections for the council, which is dominated by the NDP, were last held in May-June 2004.

**The Judiciary**

Egypt's overloaded judiciary is independent, but the government tends to circumvent rulings not to its liking, often by employing the state of emergency regulations that have been in force since Mr Sadat was assassinated. These allow the police almost unlimited powers of search and arrest, and control of the media. "Fast track" military courts are used to try Islamist cases as they are considered to be more effective in achieving convictions than civilian trials, which can take years, in part because of legislative complexities.
The Executive

Although formally accountable to parliament, the prime minister is the president's primary lieutenant and is responsible for implementing his policies throughout Egypt's all-pervasive bureaucracy. Important decisions are made by the president in consultation with ministers and advisers. The main ministries are defense, foreign affairs, information, economy and interior.

International Relations and Defense

Close neighbors

Egypt's historically close ties with the US, its status as the most populous Arab country and its tireless diplomacy have enabled it to carve out a position as a regional powerbroker, and following the demise of several influential leaders in the Arab world--King Hussein of Jordan and King Hassan of Morocco both died in 1999, followed by the Syrian president, Hafez el-Assad, in 2000--Mr Mubarak has become the unquestioned senior Arab statesman. Relations with Sudan, which had been tense since June 1995 when there were allegations of Sudanese complicity in an assassination attempt on Mr. Mubarak, warmed considerably following the ousting from the inner circle of power of Sudan's Islamist leader and parliamentary speaker, Hassan al-Turabi, in 2000. Despite periodic setbacks and concern over the nature of Muammar Qadafi's rule, relations with Libya have also improved under Mr Mubarak, as Egypt views its neighbor as the provider of an important source of employment for its labor force, and as a useful buffer against Islamist extremism within the region.

However, Egypt's regional diplomatic clout has suffered under the presidency of the US president, George W Bush. Egypt was taken aback by the fact that it did not have a say in the US-brokered Machakos Protocol, a framework peace treaty signed in July 2002 between the Sudanese government and the southern Sudanese People's Liberation Army, which allows for the possibility of a referendum on the issue of the secession of the south after a six-year interim period. Egypt considers the issue to be of strategic importance for its own interests: its main concern is the security of its share of water from the River Nile.

Further afield, Egypt has improved relations with both Turkey and Iran. Egypt's role in the 1990-91 Gulf crisis strengthened its relationships with Gulf states considerably, particularly with Saudi Arabia. Egypt's entry to the Common Market for Eastern and Southern Africa (Comesa) in June 1998 and its participation in that body's free-trade area, launched in October 2000, serves to highlight its push to revive neglected trade ties with Africa. A major focus of foreign policy is to open up new export markets, but the emphasis on upgrading relations with Africa also has
another dimension: the Nile runs through nine other states, and Cairo is likely to have to make water agreements with all of them.

Western powers
Since the signing of the Camp David accords, Egypt's most important international relationship has been with the US. Relations strengthened as Egypt played a crucial role in winning over Arab support for the US's campaign to oust Iraq from Kuwait in 1991-92, and then fulfilled the role of key Arab partner in US efforts to achieve peace between Israel and Arabs. In the early part of this decade, however, the foundations on which this relationship was built were shaken. Egypt's ability to influence the Israeli-Palestinian conflict waned, as for stretches there was no peace process to speak of; when the US re-engaged, the decisions were frequently made bilaterally between the governments of Mr. Bush and the Israeli prime minister, Ariel Sharon. Moreover, Egypt's direct ties with the US came under strain as the US's global "war on terror" led to unprecedented scrutiny of the nature of Mr. Mubarak's rule. Egypt therefore welcomed with gusto the opportunity to advance the peace process provided by the death of the Palestinian leader, Yasser Arafat, in November 2004. Simultaneously, the US has, in reality, receded somewhat from its initial ambitions for the promotion of democracy in the region, thereby allowing Egypt greater leeway. However, overt pressure from US policymakers for greater political plurality will endure - at least until the end of Mr. Bush's second term, and probably beyond-as the policy now forms a central part of US foreign strategy.

Ties with the European Union, Egypt's largest trading partner, are gaining higher priority as Egypt looks to balance its ties with the US. A wide-ranging Association Accord with the EU - aiming to strengthen political, social and, particularly, economic ties - came into effect in June 2004 after years of negotiations.

Job Creation, The Paramount Challenge for Egypt
Egypt's population stood at 71.8m in January 2005, according to the latest official estimates, with 69.9m resident citizens and some 1.9m others working abroad. The Economist Intelligence Unit expects the population to rise to almost 81m by 2010 and to above 98m by 2020. Reducing the population growth rate presents a major challenge for the government. The domestic population growth rate slowed slightly in 2004 to 1.84% (compared with 1.96% in 2003). More than half of the population is under 24 years old, while less than 4% are over 65. With such a youthful population, the pressures on the labor market and social services are considerable. According to the Central Agency for Public Mobilization and Statistics (CAPMAS, the national statistical
agency) the labour force grew by 2.4% during fiscal year 2005 (July 1st 2004-June 30th 2005), to 21.2m. Of this total, some 19.1m are employed. According to the latest data, in fiscal 2003 the workforce was made up of 5.3m civil servants, 900,000 working in state enterprises, 5.1m in the formal private sector and 6.9m in the informal private sector.

"A mission of the International Monetary Fund led by Mr. Klaus Enders (31), the mission chief for the Arab Republic of Egypt in the Middle East and Central Asia Department (MCD), visited Egypt during April 3-16, 2006 to conduct the 2006 Article IV Consultation discussions. Mr. Mohsin Khan, the Director of MCD, attended the policy discussions.

"The mission took stock of recent economic developments and reviewed future economic policies. The discussions serve as input for the preparation of the annual report on Egypt for the IMF Executive Board. The discussions were conducted against the backdrop of accelerating economic growth, low inflation, strong balance of payments and foreign reserves positions and, more broadly, growing confidence in the direction and depth of economic policies. The establishment of a smooth-functioning foreign exchange market has been a major source of market confidence. Banking sector reform and privatization are moving ahead at a pace exceeding expectations. In the fiscal area, there has been progress in strengthening the tax and customs regimes and bringing more transparency and efficiency to budgetary operations.

"Job creation is the paramount challenge facing the Egyptian authorities today. Indeed, the ongoing reforms are aimed at laying the ground for sustained private sector-led investment and growth. The next phase of reforms would need to reduce the constraints on private sector activity arising from weaknesses in financial intermediation, absorption of a large share of national savings by the public sector, and bureaucratic barriers to business development. Implementing these reforms will require building a strong political and social consensus. At the same time, the timing is appropriate, given the unique combination of favorable economic conditions, the strong reform momentum, and growing investor confidence.

"The IMF team views fiscal policy as the key to maintaining macroeconomic stability. The budget deficit and public debt in Egypt—while still manageable—are relatively high, and cannot be sustained at current levels without compromising Egypt's economic potential. The recent tax reforms were an important development, and need to be complemented by an ambitious and credible medium-term fiscal consolidation strategy that puts public debt as a share of GDP on a firmly declining path. Toward this end, the authorities agreed with the team on the need for a comprehensive expenditure reduction program, aimed at rationalizing the size of government, increasing the productivity of expenditure, and improving the targeting of pro-poor spending.
Meanwhile, the team welcomes the authorities' structural reform efforts aimed at streamlining cash management. "The policy focus of the Central Bank of Egypt (CBE) should remain on keeping inflation low, building on its success so far. The CBE is also moving forward on schedule to implement its multi-year program of financial sector restructuring and divestiture, and to strengthen bank supervision. "The government has made impressive progress with its privatization program. Ongoing efforts to reduce red tape, enhance the flexibility of labor markets, and facilitate access to finance and land for small and medium-sized enterprises, are welcome and should accelerate in order to bring Egypt's business environment closer to those prevailing in successful emerging markets. "Finally, much progress has been made on data quality in Egypt, but both the authorities and the Fund team share the view that further improvements in this area are required in order to better support economic analysis and effective policy formulation. In particular, additional work is needed to improve statistics on prices, balance of payments, real indicators of economic activity, and public finances. The IMF stands ready to continue providing technical assistance to Egypt in improving the statistical base."

Education

Enrollment success

In 1960 there were only 2.7m primary school student but by fiscal 2002 this had risen to 7.2m. By fiscal 2003 the ratio of primary enrolment had reached 97% and secondary enrolment had risen to 88% from 71 % in fiscal 1991. The number of students in higher education had risen from 134,000 in 1960 to 1.5m in fiscal 2002. These increases are partly accounted for by population growth, but they also reflect the government's commitment since the 1960s to provide free education for all.

High population growth places severe demands on the under funded education system. According to CAPMAS, a major school building program to raise the number of primary schools to 15,653 in 2001/02, up from 14,654 in 1993, succeeded in lowering the average number of primary school students per class to 41 in 2001/02, compared with 44 in 1996/97, although the ratio remains high and can be far higher in densely populated and poor areas. The government's bias towards high cost urban and tertiary education has resulted in unequal access to education for different groups within the country, with women in Upper Egypt the most deprived. As the state system is overloaded, some 70% of students take extra private lessons.
The proportion of Egyptians with university degrees rose from 4.3% in 1986 to 7.3% in the late 1990s. There are 13 state universities, five private universities, the Islamic university of Al Azhar and 125 technical institutes.

**Skills shortages**

The rigid education system, with its emphasis on rote learning over critical thinking and its ranks of poorly paid and trained teachers, is failing to supply the labour market with the necessary skills. Illiteracy has fallen gradually but is still high, according to the World Bank. Male literacy among the 15-and-over age group stood at 67% in 2002, with female literacy at 44% in the same year, up from 60% and 34% respectively in 1990. In the 15-24-year-old age group, 79% of men were literate in 2002, compared with 71% in 1990, and 67% of women were literate, up from 51% in 1990. (12)

**Natural resources and the environment**

**Land use**

Egypt's total land area is just under 1m sq km, of which only 35,190 sq km is settled and cultivated. About 95% of the land is uninhabitable desert, so that more than 97% of the population lives in the narrow strip of the Nile Valley that runs the length of the country, and in the Nile Delta. Population density in non-desert areas is therefore high, at about 870/sq km. The governorates of Cairo, Giza and Kalyoubia, which include Greater Cairo, contained 16.7m inhabitants in 2002. Cairo has a population density of about 31,700/sq km, and in some urban districts the density reaches more than 100,000/sq km. Government concerns about overcrowding in the Nile Valley and the destabilizing social problems that could result were the main impetus behind the Southern Valley development project that aims to reclaim a large swathe of desert by pumping water from Lake Nasser.

**The Nile**

The government and the public are slowly becoming aware of the need for environmental protection, and the country's first environmental action plan was produced in 1992 with assistance from the World Bank. With little rainfall, the country relies on the Nile to meet nearly all of its water needs. Egypt is currently categorised by the World Bank as under "water stress" and heading towards water scarcity: the action plan noted that about 90% of Egypt's used water goes untreated, while most of the industrial wastewater is discharged unmonitored. Air pollution levels are very high. According to the World Bank, the air in Cairo has the world's highest lead content, eight times over the internationally accepted safety level. Egyptian industries are estimated to dump at least ten tones/minute
of solid waste, 33% of which goes into uncontrolled landfills, canal banks and drains.

The security of Egypt's water supply has become of growing concern following statements by a number of riparian states that they want to revise the 1929 Nile Basin Treaty. This treaty was signed by Britain on behalf of its then colonies and gives Egypt a veto over the use of Nile waters by East African nations if it believes this would be detrimental to downstream levels. Moreover, the 1959 treaty between Egypt and Sudan apportioned the Nile waters between them, with Egypt taking the lion's share at 55.5bn cu meters/year, and failed to include any of the remaining eight Nile basin countries. Egypt, which relies on the Nile for more than 95% of its water, has always maintained that both treaties are untouchable. However, the other Nile states are increasingly questioning why they should abide by a colonial-era agreement that hampers their development.

The matter has begun to come to a head. In March Tanzania began building a 170-km water pipeline to supply dry inland towns from Lake Victoria, a project that contravenes the 1929 treaty. In early April the Ugandan president, Yoweri Museveni, criticised Egypt's long-standing monopoly of the Nile waters, demanding that "this egocentric approach on the uses of Nile water must stop" and a new treaty be negotiated. In addition, Kenya has said that it will not accept any restrictions on its use of Nile water. In response, the Egyptian government has stressed its willingness to extend technical and financial aid to the Nile basin countries, but has so far refused to back down.

Environmental protection

The government and the public are slowly becoming aware of the need for environmental protection, and the country's first environmental action plan was produced in 1992 with assistance from the World Bank. With little rainfall, the country relies on the Nile to meet nearly all of its water needs. Egypt is currently categorized by the World Bank as under "water stress" and heading towards water scarcity; the action plan noted that about 90% of Egypt's used water goes untreated, while around 50% of industrial wastewater is discharged unmonitored. Air pollution levels are very high. According to the World Bank, the air in Cairo has the world's highest lead content, eight times over the internationally accepted safety level. Egyptian industries are estimated to dump at least ten tones/minute of solid waste, 33% of which goes into uncontrolled landfills, canal banks and drains.

Transport, communications and the Internet
Railways

The rail system, which had 9,455 km of track as of the end of fiscal 2003, is the oldest in the region. Modernization will be required if the goals of carrying containerized transport from Egyptian ports to continental Africa and increasing the share of domestic freight moved by rail are to be realized. The rail network carries some 800m passengers/year, or 2.3m passengers/day (excluding the estimated 10,000 passengers/day who ride on top of carriages without a ticket), and some 12m tones/year of goods. Nevertheless, with cheap third-class trains serving more than 80% of passengers, revenue only covers around 60% of expenses. Egyptian National Railways receives some E£1.4bn/year in government subsidy, and is considered to be under funded.

Roads

Following an extensive modernization and expansion program that was begun in the 1980s, Egypt had 45,500 km of paved roads by 2005, but many are in poor condition. The four-lane, 9.5-km Mubarak Peace suspension bridge over the Suez Canal near Ismailia that links Sinai with the rest of Egypt was inaugurated in 2001, when a nearby railway bridge was also completed. The first suspension bridge over the River Nile—the 1 km, E£120m (US$27m by average 2002 exchange rate) Aswan Bridge—was officially opened in December 2002. A 250-km Greater Cairo ring road is under construction. The Mediterranean coastal road is also being renovated as it forms part of the link between North Africa and Europe's Mediterranean road network via the Gibraltar crossing. Some 85% of domestic freight and 60% of passenger movements are by road. Road safety is of major concern as Egypt has one of the highest incidences of traffic fatalities in the world, with an official death toll of 6,000 people in 2002, and 28,000 injuries.

Air Services

The state-owned carrier, Egypt Air, is by far the largest Egyptian airline, carrying some 8.6m passengers in fiscal 2004. The 72-year-old airline is a significant economic actor, employing some 22,000 people. The airline reported net income of E£644m (US$105m at prevailing exchange rates) in fiscal 2004, reversing losses of US$300m in fiscal 2002, and E£S21m (US$55m at 200S rates) in fiscal200S. The recovery is in part due to dramatic growth in the tourism sector after a downturn in 2001 and 2002.

Internet

Internet use is constrained by cost, language, rates of literacy, inadequate infrastructure and skills shortages, while e-commerce, still in its infancy, is beset by legal and regulatory hurdles. However, with strong support
from the government, which hopes to turn the country from an IT laggard into an IT hub, Egypt is witnessing something of an Internet boom. By August 2005 there were 5m Internet users, up from 535,000 in 2000. In a bold move, the government launched free Internet services in January 2002. The consumer no longer pays fees to Internet service providers (ISPs), but instead pays only the price of a regular call—extremely cheap by international standards. ISPs lease access ports from TE and purchase a dial-up number, which they then market to consumers. In return, TE pays the ISPs 70% of the revenue from connections made through their phone number. However, the measure is controversial with ISPs who complain of high leasing rates and say their profit margins are low. Many of the smaller ISPs among the 64 which were operating when the new system was introduced have since closed.

Energy provision

The switch to gas

Demand for power has continued to rise rapidly as a result of demographic and economic growth. The shortcomings of hydroelectric power, which used to provide more than 25% of Egypt's electricity, were highlighted in 1988 during the water crisis that followed eight years of drought in the catchments areas of the River Nile. In response the government launched a crash program to build power stations that would depend on locally produced natural gas, with the additional bonus that oil would be saved for export. All oil-fired power stations have now been converted to run on natural gas as their primary fuel. Installed capacity now stands at 17,600 mw, of which 84% is based on natural gas and the rest is hydroelectric, mainly from the Aswan Dam. The Ministry of Electricity and Energy is implementing plans to bring on stream 12,875 mw of new power generating capacity over the next ten years. In the first phase, financed by development agencies, 4,500 mw will be added by mid 2007, based on an assumed annual increase in demand of 7.5%. In the second phase 8,375 mw will be added by mid-2012, assuming annual demand growth of 6.6% from 2008.

Other energy sources

Nuclear plans in the 1980s, including a US$ one billion nuclear power station at Al Dabaa, were shelved owing to cost and safety considerations. In November 1997 an Argentinean-built US $100m, 22-mw research nuclear reactor became operational, replacing the 2-mw facility built by the Soviet Union at Inshas, north-east of Cairo, in 1961. Egypt now generates about 150 mw of wind power, mostly sited at Zafraana on the Gulf of Suez, but also at Hurghada and on the north coast. There are also plans to build a part-solar power plant at Kureimat as a BOOT project, which will have so mw of solar capacity out of a total
planned capacity of 150 mw. The World Bank is expected to offset the difference in cost between the solar and thermal projects.

The Economy (28)

Economics and growth

<table>
<thead>
<tr>
<th>Origins of GDP 2001/02</th>
<th>% of total</th>
<th>Components of GDP 2001/02</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade, finance &amp; Insurance</td>
<td>22.2</td>
<td>Private consumption</td>
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</tr>
<tr>
<td>Industry &amp; Mining</td>
<td>20.1</td>
<td>Gross fixed capital formation</td>
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<tr>
<td>Social Services</td>
<td>18.8</td>
<td>Government consumption</td>
<td>10.1</td>
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<tr>
<td>Agriculture</td>
<td>16.6</td>
<td>Exports of goods &amp; services</td>
<td>15.8</td>
</tr>
<tr>
<td>Transportation &amp; the Suez Canal</td>
<td>9.2</td>
<td>Imports of goods &amp; services</td>
<td>-19.6</td>
</tr>
<tr>
<td>Petroleum &amp; electricity</td>
<td>6.7</td>
<td>Changes in stocks</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Economic structure

In fiscal 2005 growth rose to an estimated 4% as the pound stabilized and business and consumer confidence strengthened following the appointment of the government of Mr Nazif. Agriculture has grown steadily, albeit modestly, at around 3-4% a year, and Egypt therefore continues to be a large-scale food importer. Despite liberalization, the public sector continues to play an important role in the economy accounting for 33% of the total GDP and 30% of the total work force. Egypt has the largest population in the Arab world and, after Saudi Arabia, the largest GDP. The economy is dominated by services, which, including public administration, account for about one-half of GDP. Tourism and the Suez Canal are important service sectors. Tourism, vulnerable to political events, has become increasingly resilient and has recovered strongly from the effects of both the September 11th 2001 suicide attacks in the US and the US-led invasion of Iraq in 200S. The Suez Canal has performed strongly in recent years as high fuel prices have made the longer trip around Africa more expensive for ships traveling between Europe and Asia.
Agriculture

Agriculture is a major economic issue in Egypt. It is an issue as a local food source, for international trade, for balance of payments, land use and water use and as a basic product for food and fiber manufacturing. Hence every aspect of the economic structure of the country relates to agriculture. Banking, transportation, tax and tariff structure, subsidies, local and international markets and health are all part of the agricultural system of a country. Not to mention politics, of course.

Agriculture's contribution to GDP is gradually diminishing, but it is still an important activity. Even though only 3% of the total land area is arable land, agriculture accounted for 13.9% of GDP in fiscal 2005 (July 1st 2004-June 30th 2005), according to local data, and 28% of total employment in 2000/01. Manufacturing industries are also important, accounting (including oil refining) for 18.2% of GDP in fiscal 2005, and are heavily concentrated in Cairo and the Nile Delta. Mining (which includes petroleum and natural gas) is also a mainstay of the economy, accounting for 14.8% of GDP in fiscal 2005 (a proportion that was swollen by exceptional oil prices) and 38% of merchandise exports, despite a decline in crude oil production. There is a large informal sector, which the finance minister has put at some 30% of total economic activity.

Subsidies

The gradual elimination of subsidies and price controls was to be a central plank of the economic reform program. Although the government chose not to implement its IMF commitment to raise energy prices to market levels by mid-1999, subsidies on basic foods were cut back in the 1990s, leaving bread, sugar and cooking oil as the only subsidized items for low-income consumers. The sluggish performance of the private sector, however, has led the government to boost subsidy spending in recent years. Explicit spending on subsidies, grants and social benefits rose from E£18.1bn (US$4bn by average 2002 exchange rate) in fiscal 2002 (15.7% of spending) to E£29.5bn in fiscal 2005 (18.5% of spending) in fiscal 2005 and was budgeted to leap to E£50.5bn in fiscal 2006 as implicit petroleum subsidies were incorporated.

Wages and living standards

With such a large public sector, the government is necessarily deeply involved in the labor market. Government estimates put the number of Egyptians employed within the country at 19.1m in fiscal 2005, while another 1.9m work abroad. As around 800,000 people join the labor market every year, finding employment is a major problem.

A long-standing government guarantee to provide work for all university graduates has produced huge waiting lists for state jobs and a surfeit of
underemployed, badly paid civil servants. Successive budgets have raised state wages and pensions, but only recently have these gone up by more than the rate of inflation. Private-sector jobs are better paid, but limited in number. Even the highest wages and salaries in Egypt are low by international standards. Recently introduced labour legislation sets a minimum wage rise of 7% on the wage on which social insurance is calculated. As the maximum this wage can be currently stands at a low £1,125 (US$195 by average 2005 exchange rate), the new law is unlikely to have a significant impact.

According to the World Bank, the poverty rate fell from 25% in 1995 to 17% in 2000 as the economy grew strongly. However, in September 2005 the World Bank director for Egypt warned that, because of the economic slowdown, poverty could be on the rise again. There is great affluence at the other end of the social scale. As early as 1994 Egypt was one of four countries singled out in the Arab Human Development Report (12) published by the UN Development Program (UNDP), as being "in danger of joining the world's list of failed states because of wide income gaps between sections of their populations".

Unemployment is still an acute problem. Official numbers show a steady rise in unemployment, up from a low of 7.9% in 1999/2000 to 10% in fiscal 2005. Although the trend is plausible, reflecting the economic downturn of recent years, most independent estimates put the rate much higher, at around 15-25%. Moreover; unemployment among graduates is considered to be even higher, at almost 40% for men and over 50% for women. Underemployment is estimated to affect between one-third and one-half of all workers.

*North-south disparities*

The north of the country is more prosperous than the south. Home to roughly 15m people, the southern, mostly rural provinces of Upper Egypt, which stretch from Beni Suef, 120 km south of Cairo, to the Sudanese border, have traditionally been neglected by the politically dominant north, where the major cities are located and the majority of economic activity takes place.
**GDP Growth and Basis**

<table>
<thead>
<tr>
<th></th>
<th>13.5</th>
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<tr>
<td>Lending rate</td>
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<tr>
<td>Government balance (% of GDP)</td>
<td>-6.1</td>
<td>-5.6</td>
<td>-7.0</td>
<td>-7.9</td>
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<tr>
<td>Exports of goods fob (US $ bn)</td>
<td>9.0</td>
<td>12.2</td>
<td>14.2</td>
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<tr>
<td>Import of goods fob (US $ bn)</td>
<td>15.2</td>
<td>21.6</td>
<td>24.0</td>
<td>26.1</td>
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<tr>
<td>Current-account balance (US $ bn)</td>
<td>3.7</td>
<td>4.0</td>
<td>2.5</td>
<td>2.6</td>
</tr>
<tr>
<td>Current-account balance (% of GDP)</td>
<td>5.0</td>
<td>4.8</td>
<td>2.6</td>
<td>2.8</td>
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<tr>
<td>External debt (year-end; US $ bn)</td>
<td>31.4</td>
<td>34.1</td>
<td>34.2</td>
<td>34.4</td>
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<td>Exchange rate E£:US$ (av)</td>
<td>5.84</td>
<td>6.20</td>
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<td>Exchange rate E£: ¥ 100 (av)</td>
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<td>Exchange rate E£: euro (av)</td>
<td>6.61</td>
<td>7.71</td>
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<td>7.22</td>
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<td>Exchange rate E£: SDR (av)</td>
<td>8.18</td>
<td>9.18</td>
<td>8.50</td>
<td>8.54</td>
</tr>
</tbody>
</table>

(28)The economist intelligence Unit 15, Regent Street, London, United Kingdom

**Egypt and the Millennium Development Goals**

The Egypt of today is a complex social and political entity, and one that faces a struggle against poverty, population growth and authoritarian government on the road to equitable human development.

The Millennium Development Goals (74) seek to eliminate poverty and foster sustaining development, taking a time horizon to 2015. They reflect a decade of conferences and summits supported by Nations. Primary issues include: infant, child, and maternal mortality, malnutrition, access to safe drinking water, access to education, completion of primary education, and "Goals," "targets," and "indicators" were discussed and outcomes, to be measured over time, were agreed upon. In 2000, the United Nations General Assembly unanimously passed and 147 Heads of State signed the Millennium Declaration, the
commitment to work toward a world in which the highest priorities are eliminating poverty, and sustaining development.

Egypt approaches the Millennium Development Goals (MDGs) as a country with a dual identity. The first Egypt is led by a dynamic, reform-minded government, and is determined to achieve prosperity and social cohesion through the mechanism of overall economic and political reform. The second Egypt is, through the effects of decades of deeply embedded poverty and political disaffection, distanced from and indifferent to the first. The majority of Egypt’s 78 million people are in the latter category. Slowly, however, things are beginning to improve as we see in the following table:

<table>
<thead>
<tr>
<th>MDG Goal</th>
<th>Targets</th>
<th>Prospects</th>
<th>For</th>
<th>Achieving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eradicate extreme poverty and hunger</td>
<td>Reduce by half the percentage of the population living in poverty</td>
<td>Likely</td>
<td></td>
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<td></td>
<td>Reduce by half the prevalence of underweight among children</td>
<td></td>
<td></td>
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<tr>
<td>Achieve universal access to education</td>
<td>Attain 100% school enrollment by 2015</td>
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<tr>
<td>Promote gender equality and empower women</td>
<td>Reduce the gender gap in primary and secondary enrollment and literacy for 15-24 year olds by 2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase the share of women in nonagricultural employment and in the national parliament</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce infant and child mortality</td>
<td>Reduce infant and child mortality by 2015 by 2/3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve maternal health</td>
<td>Reduce the maternal mortality ratio by 3/4 by 2015 90% of all births attended by skilled staff by 2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combat HIV/AIDS and malaria</td>
<td>Slow the rate of HIV/AIDS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

X

X

X

X

X

X
Increase contraceptive prevalence

Reduce by ½ the percentage of the population without access to safe drinking water by 2105

Ensure environmental sustainability
CHAPTER 4
THE NILE RIVER
Nile River Basin -- Statistics and Background Information

Area: 3.3 million km² more than 81,500 km² are lakes and 70,000 km² are swamps. There are ten riparian countries: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda.

Total rainfall and flow: The mean annual rainfall over the entire basin is about 2,000 billion cubic meters. The average annual flow at Aswan is about 84 billion cubic meters.

Irrigated agriculture: In Egypt and Sudan, irrigated agriculture is the dominating sector. Over 5.5 million ha are under irrigation, with plans to expand an area of over 4.9 million ha. The present irrigation in the upper White Nile riparian areas is very small and there are plans for a future expansion over an area of 387,000 ha in Uganda, Tanzania and Kenya. In Ethiopia, the potential identified in the Blue Nile basin includes 100,000 ha of perennial irrigation and 165,000 ha of small-scale seasonal irrigation. The other riparian countries have no potential for irrigation in the basin and depend almost completely on rain-fed agriculture.

Population: The present 280 million is expected to grow to 591 million by 2025 at an average rate of 2.5-3.0%, with an average population density of 955/1,000 ha.

Poverty indicators: GINI Index (> 50%); Half the population is below the international poverty line at $1 a day.

The History of the Nile

The Nile probably gets its name form "nahal" which means "river valley" in Semitic, later "neilos" in Greek and "nilus" in Latin. (129) It is the world's longest river, stretching 4,187 miles from its source in the mountains of Burundi. The source of the river is so far from the Mediterranean that it took man until the middle of the 20th century to find it. For centuries, the most accurate source of knowledge on the location of this source were the writings of Herodotus (Greek Historian, 460 BC), who wrote that the Nile's source was a deep spring between two tall mountains. When Nero ordered his centurions to follow the flow of the river in order to find its source, they got no further than the impenetrable valley of the Sudd. John Henning Speke thought that he had finally found the source when he reached Lake Victoria in 1862, only to be later proven wrong and forgotten by history. In 1937, the source was
finally stumbled upon by the little known German explorer Bruckhart Waldekker (127).

The Nile is formed by three tributaries, the Blue Nile, the White Nile, and the Atbara. The White Nile rises from its source in Burundi, passes through Lake Victoria, and flows into southern Sudan. There, near the capital city of Khartoum, the White Nile meets up with the Blue Nile which has its source in the Ethiopian highlands, near Lake Tana. Over 53% of the Nile's waters come from the Blue Nile. The two flow together to just north of Khartoum, where they are joined by the waters of the Atbara, whose source is also located in the Ethiopian highlands.

The river then flows north through Lake Nasser, the second largest man-made lake in the world, and the Aswan Dam before splitting into two major distributaries just north of Cairo. The two distributaries are the Rosetta branch to the west and the Dameita to the east. In ancient times, the number of distributaries was much greater, but slow water flow, human interference, and the accumulation of silt had led to the disappearance of all the other major distributaries. This has effectively led to the desertification of large stretches of Egyptian land.

In ancient Egypt, the Nile, and its delta, were worshiped as a god. The god Hapi, who came in the shape of a frog, represented the Nile delta. Several times throughout history, Egyptians have tried to unify the Nile valley under their rule by conquering the Sudan. The lands to the south of them that bordered the river were in constant danger. The Sudan was invaded during the reign of Queen Sheba, during the Roman rule of Nero, and countless other times. This is because the Egyptians have always feared that one day the Nile's waters would no longer reach their country. People believed that since the flow of the Nile was so unpredictable, something had to have been affecting it. A legend says that during one particularly bad famine in Egypt, the Egyptian Sultan sent his ambassadors to the king of Ethiopia in order to plead with him not to obstruct the waters. A Scottish traveler in the 18th century recounted a story that the King of Ethiopia had sent a letter to the pasha in 1704 threatening to cut off the water. Given this fear it is quite natural that the Nile countries desire to secure their water supplies. (127)

The modern history of the Nile conflict began with the 20th century. The English were quick to realize the importance the river would have for their colonies. Over the centuries, in the swamps of the Sudd, strong winds and the force of the river had created natural dams made up of plants and soil, similar to those made by beavers. These dams had made all navigation up the Nile past a certain point completely impossible. Soon after Sudan was reconquered in 1898, the English began to free the Nile of the vegetation which was obstructing the passage of ships. By the
time enough blockages had been removed to clear a path through the Sudd in 1904, the English had already begun drawing up massive alternative drainage plans in order to ameliorate the flow of the Nile. However, the British did not control the Ethiopian portions of the Nile, from which over 80% of the Nile's waters come. Therefore, they had to sign an agreement with the Ethiopians in 1902 in order to assure themselves that the Nile would not be interfered with. They also had to assert a significant amount of pressure on the Italians and the French so that they would not interfere with the dominance of the Nile basin (Collins, 127). This approach worked well with the Italians, but a little less well with the French. The Egyptians caused the most problems for the English as planned developments on the Nile became a disputed matter between the two governments. In 1929, Great Britain sponsored the Nile Water Agreement, which regulated the flow of the Nile and apportioned it use (131).

After World War II, the British government commissioned a complete hydrological study to be made of the Nile Basin as a whole. Unfortunately, the study was not able to include the Ethiopian portions of the Nile due to political problems. The rest of the Nile valley was included. The study was finally released in 1958 as the Report on the Nile Valley Plan. It was the culmination of 50 years of study. The report suggested various ways to increase the amount of water which reached Egypt. The most important of these suggestions was the construction of the Jonglei canal, which would divert the flow of the Nile in southern Sudan (in the Sudd) to avoid the enormous evaporation losses which occur there. The report, however, treated the entire Nile Basin as a single unity, which was unacceptable to the newly independent African states, especially since it was published just two years after the Suez Canal incident (134).

Furthermore, the Egyptians had already planned a major construction which would significantly improve the flow of the Nile in their territories. They had decided to build the High Aswan Dam in order to control the yearly floods of the Nile and in order to harvest the hydroelectric power of the river. However, this project was to have major repercussions on the lands of northern Sudan. Building this dam would mean that whole sections of northern Sudan would be inundated by what was to be Lake Nasser. There were also severe environmental concerns as to how the dam would change life on the banks of the Nile. To deal with this problem, the two nation signed an agreement on the "full utilization of the Nile waters" in 1959. This agreement stipulated that Sudan's yearly water allotment would rise from the 4 billion cubic meters stipulated in the 1929 agreement to 18.5 billion cubic meters. The Sudan would also be allowed to undertake a series of Nile development projects, such as the Rosieres Dam and the Jonglei Canal. In exchange,
Egypt would be allowed to build a huge dam near the Sudanese border which would regulate the flow of the river into Egypt and provide water during droughts. The result of this dam, however, would be the inundation of over 6,500 square kilometers of land. The treaty also formed a joint committee which would be in charge of supervising and directing all development projects which affected the flow of the river (135).

This agreement was only bilateral and did no include any of the other riparian countries of the Nile despite the fact that it portioned out all of the Nile's water. Ethiopia, from which 80% of the water comes from was not even consulted and no water was even allotted for future usage by any upstream country except Sudan. All of the Nile's average water flow is divided between the two most downstream countries. Nevertheless, this 1959 agreement is still the most comprehensive agreement ever signed on the use of the Nile's waters.

Apparently, the residents of northern Sudan and southern Egypt were not consulted on the treaty either. In the 1960's, over 100,000 Nubians lost their homes due to development projects stemming from that treaty (140). Some of these same people had to be moved again in the 1990's in order to build another dam, this time near the border with Ethiopia. The government of Sudan said that these people would be compensated, but the overwhelming feeling amongst the villagers was that they would not be. One villager claimed "We were not informed when the government decided... to build a dam in our area. They just sent tractors with a large number of strangers. These strangers were surveyors." (126).

Construction of the High Dam at Aswan began in 1959 -- as soon as the agreement with Sudan was signed. When it was finally finished in 1970, the dam was more than 17 times the volume of the Great Pyramid at El Giza. It now stretches 4 kilometers across the river's path, rises over 100 meters for its base, and is almost a kilometer thick. Behind it, the waters have formed Lake Nasser, which is 600 kilometers long and 50 kilometers wide in some places. This reservoir is the second largest man-made lake in the world. The Aswan Dam is arguably one of the great architectural accomplishments of the 20th century. To build it, Egypt had to obtain outside funding, because it was to cost over one billion dollars to build. Rebuffed by the United States and the World Bank, Nasser had to turn to the Soviet Union, which was only too glad to help (135).

In the 1970's Sudan and Egypt began the joint construction of the Jonglei Canal, which would have increased the flow of the Nile waters by diverting the Nile away from an area where a great deal of water is lost to evaporation. Unfortunately, construction was stopped in 1983 one hundred kilometers short of completion due to "rebel action". The civil
The war in the Sudan has taken its toll on the development project, which was funded in large part by the World Bank. The failure of this project was a great failure for both the Sudanese government and the World Bank. Over 100 million dollars were spent on the Jonglei Canal project (135).

The most complete agreement on the use of the Nile waters remains the 1959 agreement between Sudan and Egypt. This agreement, however, did not put an end to the conflict over the rights to the Nile waters. A strong tension still exists between the Nile basin countries whenever a new Nile development project is proposed. The water needs of all of these countries are barely being met now and will probably not be met in the future, especially in view of the development plans in Ethiopia and Sudan. In addition, Egypt, as the country most in danger of losing access to the Nile waters by development projects in other countries, remains willing and able to intervene militarily in order to keep the status quo."

The vital importance of the Nile to Egypt, the river's furthest downstream state, is widely accepted and well documented. Throughout recent history Egypt has exerted the greatest degree of control over the Nile both politically and physically. Egypt's dominance over the Nile is a function of the influence of colonial agreements, the shifting, yet timely alliance and support from global superpowers, and the power of Egypt relative to the instability of the upstream states. As a result, Egypt has been able to make unilateral decisions regarding out-of-basin use of Nile water.

Unfortunately some of these decisions have put into question the responsibility and justice of Egypt's stewardship of Nile waters. Indeed, under the pressure of a burgeoning population, as well as for political reasons, the Egyptian government has for two decades embarked on a program of diverting billions of cubic meters of precious Nile water out of the basin and into land reclamation and development projects in the Sinai desert.

Conflicts and Treaties

Conflict has never been far from the banks of the Nile. The same is true of most international water ways, but none to the degree of the Nile. The source in central Africa; its value to the 10 countries through which it flows and the total dependence of Egypt and Sudan on this life line have always made the political and biological life of the river a source of conflict.

1929 Nile Basin Treaty

The security of Egypt's water supply has become of growing concern following statements by a number of riparian states that they want to revise the 1929 Nile Basin Treaty. This treaty was signed by Britain on
behalf of its then colonies and gives Egypt a veto over the use of Nile waters by East African nations if it believes this would be detrimental to downstream levels. Moreover, the 1959 treaty between Egypt and Sudan apportioned the Nile waters between them, with Egypt taking the lion's share at 55.5 B cu metres/year, and failed to include any of the remaining eight Nile basin countries. Egypt, which relies on the Nile for more than 95% of its water, has always maintained that both treaties are untouchable. However, the other Nile states are increasingly questioning why they should abide by a colonial-era agreement that hampers their development.

Nile waters come from rainfall on the Ethiopian highlands and the catchments areas of the equatorial lakes. The northern part has virtually no rainfall in the summer, while the southern area has heavy rains during the summer months. During the October-May season, both regions are relatively dry due to the presence of the northeast trade winds. The main problem that all countries of the Nile basin face is to ensure the food security of their growing populations. Except for Egypt and Uganda, all the other Nile basin countries had lower per capita food and agricultural production indexes compared to 1982. In Rwanda, Sudan, Tanzania and Ethiopia, the food-security situation deteriorated with an average of 17 percent. Access to high-quality water is likely to lead to a conflict in a situation where the availability of freshwater per capita is decreasing rapidly.

Some of the basin countries are experiencing acute water stress and others are suffering water scarcity during a large part of the year. The arid and semiarid regions of the basin are now experiencing serious environmental degradation that, in turn, affects aquatic ecosystems. The drought cycles and the threat of hunger in many pockets are creating panic among the basin societies, leading to demographic changes and mass rural migration to already strained urban centers. In such a situation of panic, further destruction of the basin’s resource base is continuing. This trend will continue in the coming decades unless a concerted effort of the basin’s nations, combined with assistance from the international community control the situation so that threats to national security are minimized.

**The White Nile**

During the rainy season, the White Nile overflows into the vast floodplain surrounding the permanent Sudd swamps, bringing nutrients and new life to the dry, cracked ground. The Sudd is one of the largest floodplains in Africa, providing watering and feeding grounds for populations of migratory mammals and birds. This floodplain borders the arid Sahelian region and is thus an important watering hole for many species as they move across the landscape. Civil war, which resumed in
1983, poses the greatest threat to conservation here. As is so often the case in wartime, conservation has ceased to be a priority, and most reserve areas in Sudan probably now only exist on paper. Moreover, the increased use of automatic weapons and vehicles has led to a decline in wildlife through uncontrolled hunting and greater accessibility to game. The incomplete Jonglei canal, at a width of 75 m, a depth that varies between 4 to 8 m, and a length of over 360 km, is also detrimental to wildlife in the area, acting as a large game trap.

The White Nile (known in various sections as the Bahr-el-Abiad, Bahr-el-Jebel, Albert Nile, and Victoria Nile) rises in the headwaters of Lake Victoria in a region of year-round rainfall, and after running through Uganda, overflows in southern Sudan into a shallow depression within the Kalahari Sands, creating the Sudd swamps at 380-450 m above sea level. The gradient of the river through the Sudd is greater than that on its subsequent course from Malakal to Khartoum (125). The southern portion of the floodplain is wetter than the northern, receiving on average about 800 mm/yr compared to the north’s 600 mm/yr. These rains fall between April and September (132), and temperatures average 30-33°C during the hot season, dropping to an average of 18 degrees C in the cold season. The Sudd swamps are extensive -- about 600 km long, and a similar distance wide. Vertisols are the main soils that have developed in the waterlogged conditions over these nutrient poor sediments, although fluvisols and patches of luvisols can be found along the river courses.

The Jonglei Canal in Sudan

*The Jonglei Canal Project in Southern Sudan: why the hurry and for whose benefit is it? By Jacob K. Lupai*

http://www.sudantribune.com/spip.php?article22060

*The author is an agricultural extension expert and a researcher on household food security with reference to peasant farming. He can be reached at jklupai@yahoo.co.uk.*

May 26, 2007 —

The expected resumption of the digging of the Jonglei canal is bringing back fresh memories of the controversies surrounding the Jonglei canal project when it first started. The project was considered one of the most important integration projects between Egypt and the Sudan with the primary objective of ensuring the flow of 4.7 billion cubic metres of the Nile water annually to be distributed between Egypt and the Sudan. It was seen as the development of modern irrigation and drainage facilities
that would put an end to agriculture being tied to the annual patterns of flooding and drought in the two countries. In 1974 Egypt and the Sudan agreed on the construction of the Jonglei canal that would drain the Sudd and provide Egypt with water needed during the arid season.

The problem was resolved when in 1929 British sponsored the Nile Water Agreement which regulated the flow of the Nile and apportioned its use. However, the Nile Water Agreement was nothing but for Egypt to consolidate its grip on the use of the Nile water. This agreement included the following:

- Egypt and the Sudan utilize 48 and 4 billion cubic meters of the Nile flow per year respectively
- The flow of the Nile during January 29 to July 15 (dry season) would be reserved for Egypt
- Egypt reserves the right to monitor the Nile flow in the upstream countries
- Egypt assumed the right to undertake Nile river related projects without the consent of upper riparian states
- Egypt assumed the right to veto any construction projects that would affect its interests adversely

In 1959 an agreement of the full utilization of the Nile water was signed between Egypt and the Sudan. The agreement is known as the Nile Waters Treaty which has been held until the present time. The average flow of the Nile is considered to be 84 billion cubic meters per year, and evaporation and seepage are considered to be 10 billion cubic meters. This leaves 74 billion cubic metres for Egypt and the Sudan to divide between themselves. According to the 1959 Nile Waters Treaty the allocation for Egypt is 55.5 and for the Sudan is 18.5 billion cubic metres per year respectively.

About 96 percent of the economically active population in Egypt is engaged in agriculture and Egyptian agriculture is entirely dependent on irrigated land. In Egypt 88 percent of the water is consumed in agriculture. As Egypt is about 98 percent desert any expansion of agriculture to feed the growing population means an increase in irrigated land. Egypt’s desperate need for enormous quantities of water is therefore abundantly clear. The Jonglei canal project was seen as the ultimate solution to Egypt’s high demand for water. In the colonial era the British were quick to realise the importance the Nile would have for their colonies in Africa. Over the centuries strong winds and the force of
the Nile had created natural dams made up of plants and soil in the swamps of the Sudd in Southern Sudan. These natural dams made navigation up the Nile past a certain point difficult if not impossible.

Egypt has an ambitious desert reclamation plan of 6,000 square kilometres of new fields so that it needs another 9 billion cubic metres of the Nile water per year. To increase the flow of the Nile in order for Egypt to realise its ambitious desert reclamation plan, Egypt sees the completion of the digging of the Jonglei canal through the vast swamps of the Sudd in Southern Sudan as the top priority.

The Jonglei canal project is likely to affect the bio diversity and ecosystem of the area. The Sudd is one of the largest floodplains in Africa, providing watering and feeding grounds for populations of migratory mammals and birds. This floodplain borders the arid Sahelian region and is an important watering place for many species as they move across the landscape. The floodplain ecosystem supports a variety of plant species. Wild rice grassland dominates the seasonally inundated floodplains.

**North Sinai**

One of the most costly and politically and economically dubious of these efforts is a huge land reclamation project in the North Sinai desert called the North Sinai Agricultural Development Project (NSADP). The North Sinai development is currently estimated to cost about $1.5 billion (about 5 billion Egyptian pounds) and is going forward despite the warnings of its own environmental impact study. Since 1987 this project has been diverting Nile water to agricultural development plots west of the Suez Canal.

However, in an even more dangerous and politically sensitive development, for the first time, plans are in place and work has already begun to facilitate the diversion of Nile water to the North Sinai desert east of the Suez Canal by means of tunnels underneath the Canal. The project was given dramatic confirmation in November 1996 when Egyptian President Hosni Mubarak, addressing Arab journalists in Cairo, announced the opening of a third tunnel underneath the Suez Canal. In addition, the Wall Street Journal reported that "In October 1997, Nile water will ... begin flowing through the Peace Canal ... and will irrigate 600,000 acres in the North Sinai desert."

The last leg of the project will bring Nile water just south of the North Sinai town of El Arish, only 40 km away from the border of the Gaza Strip at Rafah. Most alarming to many in the region are the rumors that the project will ultimately bring Nile water to Israel. As a matter of fact, a similar project was envisioned as early as 1974 by Israeli water expert,
Elisha Kally,(136) as a way of satisfying Israeli water needs.  

Tanzania pipeline

The matter has begun to come to a head. In March Tanzania began building a 170-km water pipeline to supply dry inland towns from Lake Victoria, a project that contravenes the 1929 treaty. In early April the Ugandan president, Yoweri Museveni, criticised Egypt's long-standing monopoly of the Nile waters, demanding that "this egocentric approach on the uses of Nile water must stop" and a new treaty be negotiated. In addition, Kenya has said that it will not accept any restrictions on its use of Nile water. In response, the Egyptian government has stressed its willingness to extend technical and financial aid to the Nile basin countries, but has so far refused to back down.

Proposed new commission for Nile Management

"On March 28, 2007, Aljazeera news reported that the African countries that form the Nile basin have agreed to set up a commission governing the river’s use. Kenya’s water minister reports:

The 6695 km river has been a source of conflict for decades between the impoverished nations in its catchments area and Egypt, for which it is the lifeline.

On Wednesday, March 28, 2007, Mutua Katuku, Kenya’s water minister (137), said: “We have agreed on most of the things on the Nile Basin Co-operative framework. We will be establishing a commission which will be able to regulate the use of the waters of the Nile.

Katuku said the 10 Nile basin countries were yet to decide on the definitions of some contentious terms, such as the meaning of “water Security.” But he said he expected the co-operative framework would be ready in a month’s time.”

Under a 1929 pact between Egypt and the UK, acting on behalf of its then east African colonies, downstream Egypt can veto use of water higher up that it feels threatens levels.

This agreement has generated resentment and predictions of future wars over the water of one of the world's biggest rivers.

The commission will replace the Nile Basin Initiative formed in 1999 by Burundi, Democratic Republic
Continuing Tensions (129)

The Nile river is the main source of water for the nine nations which make up the Nile basin. As is, the water provided by the river is barely enough to satisfy the enormous water demands of the region. Early in the 21st century, it is expected that at least six of the nine nations which share the Nile's water will experience acute water stress (134). Access to the Nile's waters has already been defined as a vital national priority by countries such as Egypt and Sudan. It is an issue over which the two nation's have professed themselves willing to go to war over. Current tensions between Egypt and Sudan, its neighbor to the south, are merely a continuation of a two thousand year-old struggle over who will control the regions scarce water resources. As more of the nations in the Nile valley develop their economies, the need for water in the region will increase. And while the demand for resources increases, the supply is likely to remain unchanged, drastically increasing the chances for armed conflict over the waters of the Nile river. In addition, development projects that are aimed at increasing the flow of the Nile remain endangered by tension and instability in the region, as well as by environmental and financial concerns.

In Northeastern Africa, water is a scarce commodity. Yet it is also a vital one, as it is needed for irrigated agriculture, industrial expansion, and human consumption.

In the Nile basin, the river remains the only reliable source for renewable water supplies. Underground water supplies, or aquifers, can only be harvested once and will eventually run out. This places the Nile basin countries in a position of reliance on the waters of the Nile. (121)

The waters, however, do not flow in sufficient quantities to satisfy the future water requirements of all these nations. The nations are barely satisfied by what they now receive and it is foreseen that their needs will increase as populations rise, industrial growth takes place, and more land is irrigated with Nile water for agricultural use in nations besides Egypt. Egypt's cropland is already 100% irrigated, fostering an amazing reliance on the flow of the Nile. It is estimated that Ethiopia and Sudan could achieve high levels of food production if they chose to irrigate as much land as possible.

Water stress is present when nations find themselves with less than 2000 cubic meters per person of renewable water supplies. By the end of the century at least five nations in the Nile basin expect themselves to be suffering from water stress. This figure does not include the water that would be needed to feed the citizens of the Nile countries. It is unlikely that the flow of water in the Nile could be increased without the
completion of the Jonglei Canal, which, given Sudan's internal problems, seems highly unlikely in the near future. (134)

In addition, the environmental situation is further complicated by the problems surrounding the Aswan Dam. Even though the environmental damage to Egypt's environment caused by the Dam has been much less than originally predicted, it is still quite significant. One major problem is that the silt from the river which for millennia fertilized Egypt's cropland is no longer being allowed to flow down the river. This means that more chemical fertilizers are being used. It is also causing erosion along the banks of the Nile, which were previously replenished by the silt carried down the river. Much of the Nile delta is now being swept into the Mediterranean. In fact, if barriers near the Nile's outlet continue to erode, much of low lying Egypt could find itself in the sea, as the sea slowly advances. The Nile is also bringing more salt to the fields of Egypt because of the increased evaporation which takes place in Lake Nasser. (135)

This evaporation also presents a severe problem. Over 2 meters of water evaporate from the surface of Lake Nasser every year. This is because of its location in the middle of the desert. For this reason many opposed the construction of a dam in that location. A similar dam in the highlands of Sudan or Ethiopia would lose much less water. However, if the dam were located elsewhere, Egypt would lose out on the hydroelectric power the dam provides (roughly one third of Egypt's electrical power comes from the dam).

In 1997, Egypt is to begin the construction of a new valley of the Nile, by creating a new, self-sustaining, river which would flow through the Western Desert. To do this they would cut a canal, called the New Valley Canal, which would connect a series of oases to one another. This would allow Egypt to settle a large number of people far from the Nile; something which has proven impossible up until now. Over 62 million people live on just 4% Egypt's land. This project would allow Egyptians to take advantage of the good soil quality which is prevalent throughout the country. However, the estimated cost of the project is 2 billion dollars, which Egypt does not have. However, the real problem remains that of where Egypt will find the water to fill the canal and to keep it flowing as it already its full allotment of the Nile's water (128)

A New Lake in Darfur, Sudan?

By Tanzina Vega, REUTERS

BOSTON, July 18 (Reuters) - A newly found imprint of a vast, ancient underground lake in Sudan's Darfur could restore peace to the region by
providing a potential water source to an area ravaged by drought, a U.S. geologist says.

"What most people don't really know is that the war, the instability, in Darfur is all based on the lack of water," said Farouk el-Baz, director of Boston University's Center for Remote Sensing. The potential water deposits were found with radar that allowed researchers to see inside the depths of the desert sands. The images, el-Baz said, uncovered a "megalake" of 19,110 square miles (30,750 sq km) -- three times the size of Lebanon.

International experts estimate 200,000 people have died in four years of rape, killing and disease in Darfur, violence the United States calls genocide. Sudan rejects that term and puts the death toll at 9,000. Widespread environmental problems are a root cause of Sudan's violence, the U.N. Development Programme said in a report last month, noting that deserts had spread southwards by an average of 62 miles (100 km) over the past four decades.

Many refugees from Darfur settled in regions that were once the domain of nomads, straining water resources and sowing conflict between farmers and nomads, said el-Baz.

"So now, if you find water for the farmers ... in addition to that for the nomads ... for agricultural production, to feed them, to give them grain, then you resolve the problem completely," he told Reuters in an interview.

His initiative, called 1,000 Wells for Darfur, has gained the support of the Egyptian government, which has pledged to start building an initial 20 wells. El-Baz, who expects groundwater deposits below the surface can be drilled for water, hopes for backing from other regional governments and has urged non-governmental organizations to get involved.

"As we began to look into this, we realized we were dealing with a vast low area, a depression. And then we began to look at the details of the depression and we actually found the terraces, meaning the edges of the lake, way up on the nearby mountains," he said.

"That's why we call it a megalake, because it is an incredibly large lake. It is the size of the state of Massachusetts, or Lake Erie."

Researchers said the ancient lake would have contained about 607 cubic miles (2,530 cubic km) of water when full during past humid climate phases.

"One thing is certain, much of the lake's water would have seeped through the sandstone substrate to accumulate as groundwater," el-Baz said in a report.

El-Baz, who worked on NASA's Apollo program as a supervisor of lunar science planning, conducted similar research in Egypt that led to the construction of 500 wells in an arid region of his native country. That project helped irrigate up to 150,000 acres (60,700 hectares) of farmland where wheat and other crops are grown.
Solving Problems with Research

Consultative Group on International Agricultural Research (CGIAR) www.cigar.org

The problems of the Nile region are as interconnected as the basin’s very waterways—each flows into the next. Among the most serious challenges are poverty and food insecurity, water shortages, land degradation and pollution from effluents. Deforestation and cultivation of steep slopes have led to heavy soil erosion, loss of biodiversity, and sedimentation of lakes and reservoirs. The Nile has also become seriously polluted by agrochemicals, untreated sewage and industrial waste.

Despite all these problems, however, the resources of this large and complex water system—containing ecosystems as diverse as equatorial Africa’s Lake Victoria and Egypt’s Mediterranean delta 3,500 km to the north—have enormous potential to address poverty.

The Challenge Program on Water and Food of CGIAR recognizes that efficient water use, environmental protection, poverty alleviation, and the promotion of peace and security are critical issues for the region. Directly or indirectly, the program’s scientific agenda reflect these overriding concerns.

Research priorities include:

- Enhancing rain fed agriculture in upper basin areas
- Identifying practical water saving technologies
- Improving human health
- Increasing river yield from swamps and through control of aquatic weeds in open water courses and lakes
- Promoting sustainable fisheries
- Improving hydropower potential

The transboundary nature of the Nile Basin presents formidable obstacles to sustainable resource use and national economic development. Unilateral management and control of each country’s individual territory cannot, over the long term, benefit the region as a whole. Equitable and effective water allocation and environmental protection depend on institutionalized regional cooperation. The
Challenge Program on Water and Food offers a multidisciplinary research framework for the design of trans-boundary solutions to the Nile Basin’s many challenges. The program, led by Egypt’s National Water Research Center, is complementing ongoing activities and cooperating with national and other stakeholder organizations in the region. Results of this work will be particularly valuable in other regions where water sharing and basin management require joint action by several countries. (CGIAR challenge program on water and food)

**The National Water Research Center of Egypt**

The NWRC acts as the lead organization for the Water and Food in the Nile basin. The national institutions dealing with water resources in the ten riparian countries are potential stakeholders. The Permanent Technical Commission for Nile Waters, established between Egypt and Sudan in 1960, is a good example of a sub-regional stakeholder in the basin.

Through NWRC, a close collaboration with the ongoing process of cooperation or reform (e.g., Nile Basin Initiative, Nile River Basin Cooperative Framework Project, Nile Basin Water Resources Projects, and Lake Victoria Environment Management Project) is maintained.

**Updated August 1st, 2005**

The National Water Research Centre (NWRC) of Egypt, was established 1975 by the Ministry of Water Resources Irrigation (MWRI). It is the organization responsible for research in the field of the water related issues. The organization chart of the NWRC is consisted of twelve research institutes. The NWRC through its different institutes is conducting researches in many water related fields such as irrigation, drainage, water distribution, hydraulics, river engineering, water resources planning and management, hydraulic structures and shore protection. The main objectives of the NWRC are to propose and study long-term water resources policies and solve the technical and applied problems associated with general policies for irrigation, drainage, and water resources. In addition, the NWRC is responsible for research activities conducted for the extension of agriculture land and utilizing water resources of the country in the most efficient and cost-effective way. On the regional scale, NWRC acts as the Coordination unit for the African Water Resources Network and is a member of the water resources networks in Europe and Middle East countries. (125)
PART THREE
JOINT PROGRAM DEVELOPMENT
THROUGH FOREIGN AID

Although Egypt had become almost food independent, it became clear by the late 1970’s that a major food gap was developing. With aid from the United States and several European countries, programs of joint research were initiated. Thanks to a major expansion in research and extension activities, the food supply became much more dependable by the early 1990’s. However, it was recognized that the rapidly growing population and the fragile nature of agricultural systems required a continual series of extensive programs in research, marketing, food processing and resource efficiency.
CHAPTER 5

EGYPT RECOGNIZES FOOD GAP PROBLEM

The Status of Agriculture in the Second Half of the Century

During the 1970s, despite substantial investment in land reclamation, agriculture lost its position as the dominant economic sector. Agricultural exports, which accounted for 87% of all merchandise export value in 1960, fell to 35% in 1974 and to 11% by 2001. In 2000, agriculture accounted for 17% of GDP and 34% of employment.

Cotton had been the staple crop, but it is no longer important as an export. Production in 1999 was 243,000 tons. Egypt is also a substantial producer of wheat, corn, sugarcane, fruit and vegetables, fodder, and rice; substantial quantities of wheat are also imported despite increases in yield since 1970, and significant quantities of rice are exported. Citrus, dates, and grapes are the principal fruits by acreage. Agricultural output in tons in 1999 included corn, 9,350,000; wheat, 6,347,000; rice, 5,816,000; potatoes, 1,900,000; and oranges, 1,525,000.

The government exercises a substantial degree of control over agriculture, not only to ensure the best use of irrigation water but also to limit the planting of cotton in favor of food grains. However, the government's ability to achieve this objective is limited by crop rotational constraints.

Egypt's arable area totals about 3.3 million hectares (8.1 million acres), about one-quarter of which is land reclaimed from the desert. However, the reclaimed lands only add 7% to the total value of agricultural production. Even though only 3% of the land is arable, it is extremely productive and can be cropped two or even three times per year. Most
land is cropped at least twice a year, but agricultural productivity is limited by salinity, which afflicts an estimated 35% of cultivated land, and drainage problems.

Irrigation plays a major role in a country the very livelihood of which depends upon a single river. Most ambitious of all the irrigation projects is that of the Aswan High Dam, completed in 1971. A report published in March 1975 by the National Council for Production and Economic Affairs indicated that the dam had proved successful in controlling floodwaters and ensuring continuous water supplies, but that water consumption had been excessive and would have to be controlled. Some valuable land was lost below the dam because the flow of Nile silt was stopped, and increased salinity remains a problem. Further, five years of drought in the Ethiopian highlands—the source of the Nile River's water—caused the water level of Lake Nasser, the Aswan High Dam's reservoir, to drop to the lowest level ever in 1987. In 1996, however, the level of water behind the High Dam and in Lake Nasser reached the highest level since the completion of the dam. Despite this unusual abundance of water supply, Egypt can only utilize 55.5 billion cu m (1.96 trillion cu ft) annually, according to the Nile Basin Agreement signed in 1959 between Egypt and Sudan. Another spectacular project designed to address the water scarcity problem is the New Valley (the "second Nile"), aimed at development of the large artesian water supplies underlying the oases of the Western Desert.

**Total investment in agriculture and land reclamation for the government's Third Plan (1993–1997) was £16,963 million.**

The agrarian reform law of 1952 provided that no one might hold more than 190 feddans for farming and that each landholder must either farm the land himself or rent it under specified conditions. Up to 95 additional feddans might be held if the owner had children, and additional land had to be sold to the government. In 1961, the upper limit of landholding was reduced to 100 feddans, and no person was allowed to lease more than 50 feddans (1 feddan = 0.42 hectares). Compensation to the former owners was in bonds bearing a low rate of interest, redeemable within 40 years. A law enacted in 1969 reduced landholdings by one person to 50 feddans. By the mid-1980s, 90% of all land titles were for holdings of less than five feddans, and about 300,000 families, or 8% of the rural population, had received land under the agrarian reform program. According to a 1990 agricultural census, there were some three million small land holdings, almost 96% of which were under five feddans (2.1 hectares/5.2 acres). Since the late 1980s, many reforms attempting to deregulate agriculture by liberalizing input and output prices and by eliminating crop area controls have been initiated. As a result, the gap
between world and domestic prices for Egyptian agricultural commodities has been closed. (98) (Agriculture in Egypt 1970 -1980(4)

**Government Policies Affecting Agriculture and Their Reform**

To better understand the current policy environment in agriculture, it is helpful to consider briefly the evolution of government policies affecting agriculture over the past 40 years. These policies have had a major impact on the performance of the agricultural sector during this period.

Dr. Ahmed Goueli, Governor of Ismalailia, has provided an excellent summary of the changes occurring during this period in the paper entitled "Egyptian Agricultural Policy and Challenges for the 1990's. The following is information, in part, from his paper. (39)

"Nationalism" (1952-1961)

The Land Reform Law of 1952 was the first major intervention of government into agriculture. The law imposed a ceiling on agricultural land ownership, with distribution of excess land to the landless. It also gave farm tenants rights of inheritance which, in effect, gave tenants quasi-ownership. Agricultural rent was established at a level seven times the tax rate on the land. Furthermore, the land subject to the law was organized into cooperatives known as "land reform cooperatives" and was administrated by village and district offices and a central agency. Many of these regulations and institutions are still in existence.

During this period, both domestic and foreign trade in cotton was nationalized and brought under control of the government. This system of agricultural cooperatives was expanded to include "new reform" land. The government program for land reclamation began in this phase with about 78,000 feddans being reclaimed. The Land Reclamation Policy was based on small-farmer ownership of the reclaimed land.

"Socialism" (1961-1974)

In this period, dramatic change in agricultural policy occurred, reaching the very ultimate in government intervention and control A policy of low agricultural prices was adopted to transfer the surplus of the agricultural sector to the urban and industrial sectors. Public agencies were contracted to run agricultural activities-from the farm gate to domestic consumption and exports. Land reclamation and cultivation of New Lands was organized around state farms. The Aswan high dam was constructed. With the additional water resources, a large land reclamation program was implemented, involving some 500,000 feddans.

The rate of growth in agricultural production was high, reaching almost 4% annually due to the transformation of basin irrigation land to permanent irrigation and the shifting of the growing season for maize and
rice. The late 1960s and early 1970s saw a stagnation of public investment in the economy, in general, and agriculture in particular.

"Open Door" (1974-1982)

After the Sixth of October War in 1973, Egypt adopted an open-door policy to attract foreign investment. In agriculture, slogans such as "food security" and "green revolution" emerged. The private sector was allowed, in a very unorganized fashion, to reclaim desert land for agricultural use or speculation. With large amounts of workers remittance from foreign employment, urban encroachment on agricultural land expanded greatly.

The same price policies as in 1960's for agricultural commodities continued to prevail. Due to these policies and a low rate of government investment in the agricultural sector, the high growth rate in the agricultural sector which prevailed in the 1960's was not sustained.

The most important institutional change was the creation of a village based system which took over all the functions of the village credit cooperatives. There was also a huge expansion in "food security" loans to farmers at highly subsidized rates, which was responsible for a large expansion in the poultry industry. Poultry and livestock feeds were subsidized which further stimulated the expansion in the production of animal products.

The only positive change which occurred during this period was the beginning of foreign aid in agricultural research and technology transfer, particularly by USAID.


Within two months after President Mubarak assumed the Presidency in 1981, he visited Washington, D.C. and asked U.S. President Reagan for assistance in efforts to revitalize the agricultural sector. A part of the U.S. response to this request was to send a high level "Presidential Mission on Agricultural Development" to Egypt in early 1982, comprised of experts in agricultural research, extension, administration, production, policy, irrigation, etc. to analyze the problems constraining the development of the agricultural sector and recommend actions to overcome these constraints and accelerate development. In earlier years, the food gap (the gap between domestic production and consumption) had widened significantly. (102)

The 1982 U.S. Presidential Mission on Agricultural Development in Egypt (PMADE) focused major attention on the rapidly widening food gap in Egypt, especially the spread between the amounts of food produced and consumed. This gap was increasing at an alarming rate, and PMADE recommended a number of specific actions to deal with the
In 1960, for example, Egypt had been almost self-sufficient in wheat production. By 1980, the country was importing about three-fourths of its wheat needs. This alarming gap due, in part, to a stagnant agriculture in the 1970's and early 1980's, resulted in increased attention being devoted to agriculture.

Recommendations were made for significant policy reforms that would have an impact on the problem by (1) making conditions more favorable for enhanced food production and, (2) slowing down the rate of gain in food demand. It was pointed out that cheap food, made possible by extensive government subsidies, was, in part, responsible for increasing per capita utilization by contributing to excessive waste. For example, farmers often found it desirable to buy cheap, heavily subsidized bread and feed it to the chickens and livestock. Moreover, some farmers were feeding their own government controlled and under priced wheat to livestock and buying subsidized bread for their own consumption. Both actions were resulting in increasing demand for imported wheat.

Furthermore, PMADE recognized the need for the establishment of effective programs of family planning to reduce the rate of population growth-as a primary means of reducing the rapid rate of increase in demand for food. PMADE also emphasized a number of actions needed to increase food production-above and beyond recommended policy changes. Major emphasis was placed upon the need for strengthened research and extension programs aimed at increasing agricultural output.

In its report entitled "Strategies for Accelerating Agricultural Development" (102), PMADE addressed many policy issues. For example, the report emphasized that government policies were acting to seriously constrain the growth of Egypt's agricultural sector and recommended that the GOE "Permit agricultural output and input prices to move toward world price levels." The report emphasized that "correcting distortions in relative prices received and paid by farmers is central to using resources in the agricultural sector more efficiently and reducing Egypt’s growing dependence on imported food."

Many of the government policies and other factors constraining agricultural development were recognized in an excellent report by Dr. Youssef Wally and associates, entitled "Strategies for Agricultural Development in the 1980's for the Arab Republic of Egypt," . This document, published in June 1983, proposed various strategies for addressing these constraints. In fact, when the Presidential Mission's report was presented to the Minister of Agriculture, Dr. Wally, he indicated that he was firmly committed to modifying a wide range of government policies constraining agricultural development but that these changes would have to be in a gradual, stepwise fashion.
Another related policy problem highlighted in the Presidential Mission's report was the heavily subsidized bread prices. In 1980, a loaf of "balady" bread sold for one piaster—a price that had not been increased in many years, despite high inflation rates. In real terms, prices paid by consumers for bread declined significantly from 1965-1987 causing the bread subsidy costs to approach $1 billion, representing more than half the total food subsidy in some years. Even with the low fixed prices paid to the farmer for wheat, the government was still spending enormous sums to subsidize the cost of bread. This situation was contributing to the government's efforts to keep the prices paid to the farmer for wheat low.

In 1982, Dr. Wally (98) was appointed Minister of Agriculture (MOA) a few weeks before the Presidential Mission arrived. He worked very closely with the Mission and began immediately to take steps to address the problems identified by the Mission. In late 1982, the price of bread was increased 100% to 2 piasters and the size of the loaf was simultaneously reduced almost 8%. There was another slight reduction in loaf size in 1986. Then in 1989 the price of balady bread was raised to 5 piasters and the size of the loaf was reduced another 18%. Better quality breads are priced at even higher levels. These adjustments resulted in significant reductions in GOE expenditure for bread subsidies and made it easier to raise prices paid to farmers for wheat.

**Economic Policy Reforms-- Dr. Wally**

Additional major economic policy reforms were needed to address problems that were limiting the development of the agriculture sector. In 1986 additional reforms were announced that included the following actions:

- Government controls on commodity prices received by farmers and procurement quotas on all crops except cotton and sugar cane were removed.
- Farm gate prices of sugar cane and cotton were increased.
- Farm input subsidies were removed.
- Government constraints on private sector importing, exporting, and distribution of farm inputs were removed, allowing the private sector to compete with the Principal Bank for Development and Credit. (PSDAC).
- Government constraints were removed to allow the private sector to import and export agricultural crops.
- The role of the PSDAC was gradually limited to that of providing financial services.
Limitations on state ownership of land were imposed and the sale of new lands to the private sector was facilitated.

The role of the MOA was proposed to be limited to agricultural research, extension and legislative policies along with a program to facilitate the development and implementation of economic policies.

Adjustments were made in the land tenancy system.

Interest rates were adjusted to reflect commercial rates.

Foreign exchange rates were adjusted to reflect the real value of local currency.

In summary, the economic reform program initiated by the Minister of Agriculture had as its objectives:

- removing all restrictions and distortions from the agricultural sector;
- encouraging the private sector; improving agricultural terms of trade;
- encouraging farmers to use modern technology;
- increasing cultivatable areas, productivity and farm income;
- improving the standard of living for farmers while providing food for citizens at reasonable prices;
- and increasing exports and raising the share of the agricultural sector in the social and economic development of the country. (From paper supplied by Dr. Saad Nassar-77.)

**Impact of policy Changes--immediate and long term**

This very strong process of liberalization and privatization began under Minister Wally's leadership in the early 1980's, resulted in the fact that, agriculture became the most privatized sector in the Egyptian economy. In fact, 97% of agricultural lands were held by the private sector. The impact of these reforms had immediate impacts on agriculture in the following areas:

- Interest rates rose from a subsidized level of 6% to a market rate of some 20% (now around 12%).

- There is now active participation of the private sector in trade and distribution of agricultural imports, especially fertilizer.
State managed production enterprises have been transferred to a system of holding companies while they await privatization.

State marketing systems have been privatized for all crops except cotton.

The amount and scope of agricultural subsidies have been limited.

As a result, by the end of the 1980's, productivity of major crops, including wheat, maize, rice, fruits, and vegetables had increased substantially over the levels of the 1970's.

In addition to policy changes, there were also major improvements in the development and application of improved agricultural technology through cooperative research programs funded by USAID. One of the earliest of these was the California project and another was the Farmer to Farmer program.

**Early Cooperative Research Programs--USAID**

*The ‘California Project’*

The ‘California Project’ (120) was formally entitled Agricultural Development Systems (ADS). It was known as the California Project because it was managed by the University of California, Davis. Its objective was to introduce new fruit and vegetable cultivars to improve stock and to provide material for varietal development by the Agricultural Research center. The program had two components: Agricultural Economics and Horticultural Research.

While the project did not introduce any new crops, it was successful in introducing new varieties of open field tomatoes, grapes, and strawberries. It also made significant scientific advances in rice seed multiplication by small farmers, plant pathology, plant virology, and nematology.

Tomatoes were notably successful. The variety known as UC Tomato led to dramatic increases in yields. Egypt is still growing high yield tomatoes, based on the UC varieties as well as others from Israel, introduced under the trilateral research activity, funded by USAID.

Unable to work on citrus directly because of USG regulations, they nevertheless assisted this sub sector by working on soil and water management. At the time of the California Project, the Egyptian fruit and vegetable industry was not quality- or cost conscious. By convincing Egyptians that they could grow competitive varieties, the project laid the foundation for later generations of projects, including current projects such as Agricultural Technology Utilization and Transfer (ATUT). The California Project also worked closely with the GOE on policies required
to increase horticultural competitiveness. It thus paved the way for the consensus-building mechanisms and approaches that have led to the reforms proposed and supported by Agricultural Policy Reform Program (APRP).

Farmer-to-Farmer Program

The objective of the Farmer-to-Farmer Program (3) was to increase private sector agricultural investment, productivity and income. The program used US volunteer technical assistance, US and local participant training, and outreach activities to provide Egyptian farmers and MALR extension agents with improved farming technologies and farm management techniques. It was a major influence in encouraging a true extension program to link the farmer with new technologies.

The Farmer-to-Farmer program built on the legacy of an earlier program, the Small Farmer Production Project (SFPP). Implemented in the 1980s, it provided technology transfer with credit packages to increase rural incomes and productivity.

The program, carried out by a group known as the Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance (ACDI/VOCA). It operated in 16 of Egypt’s governorates and worked with a core group of 600 farmers and reportedly reached more than 12,000 other farmers indirectly. It was also the largest program working with graduates in the new lands. The program’s person-to-person approach and multiple interventions helped farmers to increase yields, decrease costs, and improve the quality of their produce. One of the main successes of the project was that it strengthened the incentive among farmers to share successful experiences and led to the establishment of at least three farmer associations. The current AgLink project in the livestock sector (also implemented by ACDI/VOCA)(3) was later to build on the successful methodology of Farmer-to-Farmer.

Future Research in Agriculture

It was easy to recognize that a continuing flow of improved agricultural technology would be essential for the agricultural sector to take full advantage of these significant policy reforms. This recognition resulted in the continuation of cooperative research and development with financial assistance from USAID and the initiation of a new cooperative project called the National Agricultural Research Program (NARP). It will be discussed in detail in the following chapter.
CHAPTER 6
CAPACITY BUILDING--NARP

The National Agricultural Research Project

NARP, which operated from the mid-1980s until the mid-1990s, represents the largest agricultural research development project ever undertaken by USAID in Egypt, and perhaps the largest of any in the developing world. The $205 million undertaking was directed at improving Egypt’s adaptation and use of modern technology to strengthen agricultural production. (90)

In 1986, the project’s goal was to improve the capacity for state-of-the-art agricultural research in Egypt. The accomplishments of the project over its eight year life span include:

- capacity building, human resources development, seed policy, agricultural engineering,
- research system improvement, research management and administration, as well as
- improving the capability of the agricultural research and technology transfer system,
- including ARC, Universities and National Research Center (NRC).

Among NARP’s principal accomplishments was human resource development in agricultural research. More than 6,000 Ph.D., M.Sc. and B.Sc. holders participated in research under NARP. In addition, 90 students obtained their Ph.D. degrees from US universities, 20 obtained their M.Sc. degrees, and 2,150 traveled to US universities for post-doctoral training and exchange visits. This cadre of agricultural scientists is now serving in leadership positions in public and private sector institutions in the agricultural sector.
The NARP project also had an Agricultural Policy Analysis Component (APAC). Its principal objective was to provide technical assistance to strengthen the planning, policy analysis and monitoring capabilities of the Ministry of Agriculture and Land Reclamation and the Ministry of Public Works and Water Resources. This was the analytical tool used to help develop benchmarks for the policy reform component under APCP. It therefore was one of the predecessors of later programs such as APRP. It also built the foundation for later programs such as Agricultural Data Collection and Analysis (ADCA).

The NARP legacy provided a basis for a number of future USAID programs in agriculture. The best illustrations of NARP’s achievements are that Egypt’s agricultural research capability was enhanced, and that resulted in high yields of most crops, and the narrowing the food gap, despite the continuous increases in population.

**Accomplishments of Specific Institutes During NARP**

During the 10 years of the NARP program, the institutes of the Agricultural Research Center expanded their research programs through the support of the Egyptian government, resources from European governments and the financial, educational and facility support of USAID. Many of the institutes sent members to the United States for training and scientists from the US participated in joint research programs. This interaction enabled each institute to accomplish the goals needed to improve the productivity of Egypt’s agriculture.

The following summaries of the accomplishments of several institutes was a joint effort by the offices of Dr. Wally, Minister of Agriculture, Dr. Gomaa, Director General of the Agricultural Research Center and the Dr. El-Beltagy, Chairman of the Board of the Agricultural Research Center and the NARP program.

**The Veterinary Serum and Vaccine Research Institute** developed new vaccines against clostridial diseases that gave sheep and cattle a prolonged immunity. Work on the control of epizootic diseases has lead to improved vaccines for poultry and rabbits. Thirdly they have produced improved antiserum against tetanus and brucella. A new system of producing a vaccine from tissue culture cells instead of from susceptible animals improved the control of sheep pox. Rinderpest epidemics have been a continuous threat. The Institute has developed a recombinant vaccine and rapid diagnostic method via new molecular biology techniques from the United States. Training workshops on biotechnology have enabled the production of an effective Rift Valley Fever vaccine.

**The Field Crops Research Institute** focused on improving varieties on wheat, rice, corn, barley, faba beans, soybeans, lentils and fiber and
forage crops. New varieties of rice have increased yield by 32%; corn by 70%; wheat varieties that are more tolerant to extreme heat and drought; barley varieties with improved tolerance to a variety of environments and an overall increase in yield of 22%; legume research focused on faba beans and soybeans. Total production of faba beans increased by 48% due to the use of certified seed and improved varieties. Oil crop research includes sunflowers, sesame, peanuts and Canola. Canola was a new crop in the 1990’s for Egypt so they collected more than 350 lines of canola from all over the world to find varieties suitable to Egypt. The focus on sunflower and sesame was oil quality. Research on Berseem clover, rye grass, alfalfa, sorghum and millet focused on introducing new varieties and genetic lines to Egypt. The most important fiber crop in Egypt is flax. New varieties have been introduced including the very popular kenaf. Interesting too is the expansion of sisal varieties that are being introduced to reclaim desert soils. The Field Crops Research Institute is also responsible for weed control research. Better knowledge of the weed varieties and appropriate herbicides have resulted in crop production increases by as much as 30%.

**The Cotton Research Institute** (CRI) is perhaps the oldest research institution in Egypt and is one of the pioneering cotton institutions in the world. All varieties grown in Egypt belong to the upper two international quality classes, extra long staple and long staple. The average yield has doubled during the last 40 years. Cultural practices have been developed for each variety and region; methods of fiber and yarn quality evaluation have been refined. The CRI made a special effort to improve their technology transfer capability.

**The Plant Pathology Research Institute** (PPRI) has identified genes conditioning resistance for leaf and stem rust as well as genes that confer resistance to rusts. As a result, several high yielding varieties have been introduced, and selection of genetic sources to smut have also been carried out. One of the most serious diseases of corn in Egypt is late wilt caused by Cephalosporium maydis. Resistant cultivars have been introduced resulting in an increase in production to 3 tons per feddan. Tomato is one of the most important vegetables in Egypt, diseases of Verticillium and Fusarium have plagued the industry. Three new cultivars resistant to these diseases were selected. Phytophthora has been a serious threat to tomato and potato production often devastating the crop from 50% to 100%. New systemic fungicides have reduced the lose to about 5%. Post harvest management has focused on reducing the used of fungicides on edible crops to reduce public health hazards. The use of modified atmospheric storage has helped control molds and rots that affect post harvest storage of fruits and vegetables and hence the ability to ship products to markets outside of Egypt.
Virus diseases affect numerous crops and cause huge or even total loses. By using advanced molecular techniques such as the Elisa immuno assay and the Octerlony technique, detection of several very serious diseases including Barley Yellow Dwarf, Faba Bean Necrotic Yellow Virus and Tomato Yellow Leaf Curl Virus have been made possible cooperation between the PPRI and the CRI has lead to the development of cotton varieties with resistance to cotton wilt with the result that there were no serious outbreaks of wilt during this 10 year period.

Recognizing the importance of mechanizing Egyptian agriculture, the MOA established the Agricultural Engineering Research Institute in 1983. The institute developed equipment using laser techniques to improve land leveling for more efficient use of irrigation water. They also developed equipment for efficient seed planting and cereal crop harvesting and threshing.

The Agricultural Genetic Engineering Research Institute (AGERI) was established in 1989 as a commitment to develop expertise in agricultural biotechnology. Its primary objectives were:

- to reduce the dependency on pesticides through the production of transgenic cotton;
- produce transgenic potato plants resistant to potato virus and potato leaf roll virus;
- enhance nutritional quality of faba beans by adding the methionine gene;
- cloning the genes in tomato related to stress-tolerance and disease resistance;
- develop an efficient regeneration and transformation system in maize to develop resistance to corn borer insects;
- map the genome of rapeseed to develop varieties suitable to Egyptian conditions;
- develop efficient diagnostic tools for the identification of major virus diseases of crops in Egypt.
Soil and Water Research Institute (SWRI)

During the NARP years, SWRI accomplished a series of important successes in numerous departments:

Remote sensing: Soil mapping and classification were completed for 1.2 million feddans in the Eastern Delta and 0.7 million feddans in western Nubaria. An evaluation was carried out for salt, sea and sand affected Delta soil. Changes in the course of the River Nile, location of islands and the status of the Damietta branch were monitored. Land-use mapping was completed for 7.5 million feddans in Egypt.

Soil survey and studies: From 1983 to 1986, a major project on land resources resulted in revising earlier studies on soil on both banks of the Nile Valley in Upper Egypt, the Eastern Delta and the Suez to update soil maps.

Plant nutrition and soil fertility: SWRI surveyed the fertility of 4 million feddans and recommended supplementing rice nurseries with zinc sulfate. This resulted in a 20-25% increase in rice yield.

The Agricultural Microbiology department inoculated 90% of the soybean, 40% of the peanut, 30% of the lentil and 25% of the bean acreage with Rhizobia specific for each legume.

Because of the problems of soil and ground water pollution with nitrates and heavy metals, the institute established a network of more than 4000 observation wells. Limited water supplies of water have lead to the reuse of drainage water and the suitability of ground water was evaluated. Water consumption of field and horticultural crops was determined. The number of irrigation cycles for major field crops and the feasibility of reducing water use were evaluated.

Animal Reproduction Research Institute research has improved the reproductivity in cattle, buffalo and sheep. Gonadatrophins were extracted from buffalo pituitaries for diagnosis and control of ovulation in livestock. A mass survey of reproductive diseases was conducted throughout Egypt. As a result brucella infection has dropped from 3% to 0.25% and camplyobacteriosis from 5.3% to 0.3%. Trichmonas fetus has been eradicated. Brucellosis was recognized as being the most devastating problem. The strict test and slaughter program being followed has caused a drop in the disease to about 2% in Cattle and 0.9% in buffalo. In addition the test used has been improved through the use of the ELISA system of testing. Diagnosis and control of newborn calf diseases revealed that 10 to 15% of newborn calves die during the first two weeks of age due to diarrhea, respiratory infections and
mismanagement. Treatment with specific and non-specific immune stimulants and the isolation and identification of bacterial and viral agents causing enteritis and pneumonia using ELISA have been effective in reducing loss. Fundamental research on the freezability of buffalo semen with the result that the conception rate increased by 60%. Similarly in sheep the use of improved artificial insemination has improved wool and mutton production and the conception has improved from 56% to 77%.

**Animal Health Research Institute** (AHRI) was designated as the national institution responsible for the preservation of animal resources in Egypt. AHRI worked to fulfill its role through its diagnostic research efforts and by providing services to the community. AHRI is responsible for recommending treatment and preventive measures to inhibit the spread of diseases. Not only are its efforts vital for the preservation of animal resources, but also for the protection of human health. To meet these goals, AHRI is actively involved in overseeing various aspects of animal health in Egypt.

With an overwhelming array of viral and bacterial strains of enzootic and exotic animal diseases, and a supply of animal stock that is often limiting, AHRI is constantly concerned with updating its diagnostic techniques and improving its recommended control methods. Although the ELISA technique was introduced into the institute nearly a decade ago, it still carries promising potential for more widespread applications including, but not limited to, the identification of pathogenic bacteria. For enhancing diagnosis, the prospects hold plans for more efficient utilization of such equipment as the fluorescent and electron microscopes and cell culture techniques.

**Central Laboratory for Aquaculture Research** (CLAR) In its short history, CLAR has performed extensive research in a wide variety of subjects. One area of major concern for aquaculture in Egypt is the supply of water. In an effort to conserve water from the River Nile, CLAR studied the use of ground water in fish culture systems. With ground water being used more extensively, water quality becomes a critical issue. The development of fish culture systems requires a full accounting of water quality, especially of heavy metals, which are produced by rain water percolating through the Earth's crust. In one study, high concentrations of iron were detected in the water drawn from a depth of 100 meters. High levels of iron destroy the liver cells and gills and decrease the growth rate of common carp and Clarias lazera. Treating the underground water using KMnO4 lowered the iron content to a permissible level and restored water quality.
Also in the area of water use, different management systems were compared, such as multiple harvesting against traditional methods. The effect of fresh water and drainage water on pond productivity was investigated in a comparative study.

Several studies on reproductive physiology shortened the interval between pituitary extract doses and showed that pituitary gland extraction is superior to using injections of gonadotrophin and steroid hormones. The effect of stocking rates on growth performance, production and carcass traits of mullet in polyculture systems has been evaluated; however, mullet culture is still based entirely on natural spawning. This results in insufficient numbers of fish for stocking the ponds. Efforts are under way to spawn mullet artificially and thus improve stocking rates.

Other polyculture systems under study include fish-rice and fish-duck systems. The best techniques for duck production are being evaluated. Researchers already know that in a fish-duck system, efficient use is made of total biological production in a pond, and total protein production can be doubled.

Tilapia is considered one of the most desirable fish for aquaculture because of the good price its high quality meat commands. However, because Egypt has a semiarid climate and tilapia is a tropical fish, special measures must be taken to ensure success. Since most tilapia do not eat or grow at temperatures below 15°C and will not spawn at temperatures below 20°C, they must be over wintered indoors.

CLAR has devised a low cost over wintering system suitable for Egyptian conditions. In addition, enhancing the growth of Nile tilapia through the use of the dietary steroid hormone “17-methyltestosteronell” has been studied.

With respect to nutrition, a number of topics have been investigated. These include the effect of natural food and artificial feeding on growth performance of mullet, winter feeding regimes of Nile tilapia, physical and nutritional modifications for improving the commonly used cattle feed in fish farms, and the effect of dietary levels of protein on the growth and reproduction of Nile tilapia.

In the area of genetics of salinity resistance, different species of Tilapia and mullet collected from varied locations were used to investigate differences in gene expression. The use of electrophoresis techniques to analyze the data indicated that salinity locations influenced gene expression among species.
The rapidly growing demand for fish cannot be met by a reliance on traditional fisheries and existing fish farms. Therefore, CLAR is actively engaged in extension programs designed to increase the acceptance of aquaculture, thus providing employment opportunities and increasing the supply of fish.

Since its inception in 1987, the Central Laboratory for Agricultural Expert Systems (CLAES) has established itself at the forefront of agricultural expert systems applications in the developing world. CLAES occupies a unique position for conducting original research on the use of expert systems in agriculture. The laboratory achieved early success in adapting pre-built expert system shells to local conditions. In addition, original expert system programs were created at CLAES for the cultivation of cucumbers under plastic tunnels. These locally designed programs are a great source of pride for the scientists and staff of CLAES.

Studies have shown that expert systems help improve the performance of extension agents, the vital link between research activities and the field. The expert systems training courses provided by CLAES increase the knowledge base of extension agents and speed the introduction of new technologies and agronomic practices. Expert systems already in place are helping farmers prepare land for cultivation, establish water and fertilizer regimens and identify and treat 45 cucumber and 50 citrus disorders.

Official Report and Evaluation of NARP

In early 1994, USAID Egypt requested that Tropical Research and Development, Inc., of Gainesville, Florida, organized an assessment team of U.S. specialists to evaluate the performance and impact of the Egyptian National Agricultural Research Project (NARP) and recommend the nature of future USAID support. The following paragraphs are a summary of the evaluation team’s report. The full report is available through USAID Egypt (Cairo), the Ministry of Agriculture and Land Reform, Cairo, Egypt, and Tropical Research and Development, Gainesville, Florida, USA. (York, E.T.--105, 119)

A Dynamic Agricultural Transformation through Research and Policy Reform

"Egypt is in the midst of a dynamic agricultural transformation, highlighted by unprecedented yield gains and production of its major crops. For a country that has limited arable lands and water supplies and that already enjoys high crop yields, this is a tremendous accomplishment. This progress has resulted, primarily, from effective
research programs and significant policy reform during the past 10- to 15-year period.

The case for research in Egypt is easy to make. Limited land, limited water, rapidly growing population, food needs outstripping production—these require continuing intensification of production on a limited natural resource base. Such intensification requires increasingly higher yields, greater input efficiencies, reduced negative environmental effects, a greater knowledge base, and superior management. But this picture, while daunting, is not all bleak, for the Egyptian farmer is one of the best in the world. Egyptian farmers know much about the land and the soil and water to be managed; they also possess an abundance of knowledge and experience concerning the art and craft of farming.

While the Egyptian farmer is exceptional in skills and acumen, to continue to be successful, each farmer also needs a continuous flow of new technologies. Only a productive, problem-solving research system can fulfill that need. We are convinced that Egypt is building an effective research system to help solve its agricultural and natural resource management problems, and that such a research system is essential to Egypt’s future. The National Agricultural Research Project and its predecessor projects have played a key role in the changes and improvements that have taken place, and the work that the project has begun or stimulated will become even more valuable in the future. What is important now is to build on the base that has been established in order to ensure that Egyptian agricultural science can be vibrant and innovative in solving the great problems faced.

Yield growth in major Egyptian crops can only be described as phenomenal over the past decade. Productivity gains for many crops have been exceptionally great since the early 1980s. Moreover, since 1981 Egypt’s agricultural performance far exceeds the average for the rest of the world in rate of gain in the indices of total agricultural production, agricultural production per capita, total food production, and food production per capita. It should be noted, as well, that with 31 of 32 major crops Egypt exceeded world average yields. With two crops, Egyptian yields were the highest in the world. For several other crops, Egypt ranked second or third in the world in average yield.

In the performance of animal-based agriculture, Egypt has not done as well as with crops-except, perhaps, with poultry. For example, Egypt’s production of milk per cow equals only one-third of the world average."

**Advances in Egyptian Agriculture**

"There have been very significant advances made in Egyptian agriculture since 1985 during the period of the NARP’s existence. It cannot be said, however, that the National Agricultural Research Project, by any means, was totally responsible for such improvements. We believe these
improvements can be attributed to three major factors (not in any priority order):

1. The major policy reforms implemented during the past 12 years under the dedicated and enlightened leadership of Deputy Prime Minister Youssef Wally (98). Many of these reforms have removed significant disincentives that were holding back agricultural development, providing a policy atmosphere that is much more supportive of such development.

2. The improvement in agricultural research programs made possible, in part, by the USAID-sponsored projects in the late 1970s to mid-1980s. These projects helped to provide the technology and demonstrated the capacity to increase agricultural output significantly. We would note that this significant progress would likely not have been realized in the absence of either the policy reforms or the improved research programs. Each was, in some respects, dependent on the other for its full impact to be realized.

3. Contributions by NARP, building on the foundation established by the earlier USAID-supported research projects, including a major policy project. The NARP has not only built on that foundation but also has supported other research areas not covered by the earlier projects. The results of these efforts will likely be felt primarily in later years.

NARP has also supported extension and technology transfer activities that are vital to help the farmers apply the technologies generated through research. These programs are beginning to contribute to more rapid adoption of new technologies and the further strengthening of the agricultural sector.

Improvements in the seed industry in recent years—also a major objective of NARP—are beginning to contribute to the improvement of the agricultural sector.

The New Initiatives component of the NARP has provided an excellent vehicle to address emerging problems or opportunities that could not be anticipated when the project was originally designed. The benefits of most of these efforts will be realized after the National Agricultural Research Project has been completed.

With 21 major crops there was a modest increase in the crop production index from 1980 to 1983 (1 percent annual increase)—but a substantially higher rate of 36 percent from 1983 to 1990, reflecting a 4.5 percent annual growth rate. These data indicate that improvements in crop production have not been limited to cereals only but significant improvement have been made in a broad spectrum of other crops as well. Such advances with the 21 crops are even more dramatic when changes in the current or nominal value of these crops during this period are
examined. These data indicate a growth rate in nominal values of these crops of some 19 percent annually since 1980-with growth much more rapid since 1984.

Such improvement in value reflects not only greater production but also significant improvements in prices of the commodities resulting from the major policy changes of the 1980s and early 1990s.

These rapid gains in current value since 1980 reflect inflationary price increases as well. However, there were also significant improvements in the real value of this production. In fact, in the period from 1980 to 1990 the real crop production value increased 89 percent with an annual growth rate of 6.6 percent. Such improvement in the real value of such improvements in production, we believe, has been reflected in significant advances in income to the farmer. Perhaps the significance of these improvements is best reflected in the fact that wheat production increased more in Egypt since 1987 than in all of Egypt’s history prior to that date.

But the greatest impact of the NARP, we believe, is yet to come. The National Agricultural Library is yet to be equipped and stocked. Laboratory equipment, vehicles, and many other commodities are ordered and are yet to arrive. Buildings and laboratories are still being renovated, and improvements continue to be made in upgrading the land and other infrastructure at the research centers.

Important improvements are being made through the technology transfer program in upgrading facilities for extension workers. At some nine locations, management information systems for use by extension are being installed through the technology transfer component.

Four regional research and extension councils have just been formed for the major regions of Egypt. When fully activated they should serve a very useful function in helping to coordinate more effectively the total research effort of the country and in focusing attention on continuing needs for research and extension as new problems emerge.

The extensive training program, which is still in progress, should continue to pay dividends for many years to come. Significant improvements have been made in the seed industry, which should contribute to further improvements in the agricultural sector.

Measuring capacity for effective research is very difficult and, at least, somewhat subjective. However, we have identified several indicators that we believe are important in assessing the development and effectiveness of a national agricultural research system. There is strong and unmistakable evidence that NARP is greatly enhancing Egypt’s capacity to do excellent agricultural research. All of the capacity-building indicators discussed in our report point strongly to an enhancement which should contribute to Egyptian agriculture well into the twenty-first century."
Closing the Food Security Gap

"In the report of the U.S. Presidential Mission on Agricultural Development in 1982, major attention was devoted to the "food gap" in Egypt. The gap had been increasing since 1960 when Egypt was essentially self-sufficient in food. Food production increased at a steady but slow’ pace from 1960 to 1980. However, utilization of the 10 primary food products-wheat (and flour), maize, groundnuts, lentils, sugar, cooking oil, red meat, white meat, dairy products, and fish-was increasing at a much faster rate than production, especially from 1974 to 1980. If nothing had been done to modify these two trend lines, the food gap would have grown from approximately one million tons in 1960 to nine million tons in 1980 and 26 million tons in 2000 (figure 1 [in the full report, figure 5.5]).

From 1980 to 1992, however, there was a sharp increase in production, primarily since 1985, with a distinct slowing down in the rate of increase in food utilization. These changes in the slopes of the two curves since 1980, when projected to the year 2000, show a potential food gap in 2000 of some 4.5 million tons. This gap is about 17 percent of the projected gap that would have occurred in 2000 based on extrapolations of the trends in 1980 (fig 2)"
Most of this narrowing of the gap has resulted from the sharp upturn in production since 1985. It is obvious, however, that the rate of utilization is beginning to slow down as well.

These changes were also reflected in wheat imports, which reached a maximum level of around 7.4 million tons in 1987 and dropped to around 5.3 million tons by 1993.

Data indicate that little progress has been made since 1980 in improving the self-sufficiency level in vegetable oil, fish, and red meat. This would suggest that there is significant need to produce more of these products for domestic consumption.

There is considerable evidence that technology is available to facilitate significantly higher crop yields than are currently realized. Despite this, perhaps Egypt should never be expected to fully close the food gap or to
become totally self-sufficient. It would be desirable, however, for Egypt to become self-reliant or economically self-sufficient in food production. This would entail exporting sufficient products from agriculture to cover the costs of importing the agricultural commodities that were not produced domestically.

There would appear to be excellent opportunities for such exports, especially of higher valued horticultural products. Several factors make this feasible: the nearness to large markets in Europe and the Gulf States; the ability to supply these markets during winter months when needs in Europe, especially, are greatest; unusually favorable weather conditions, including an almost totally frost-free climate; the ability to control water supplies; the absence of major, damaging storms, etc. In fact, Egypt has been likened to a large greenhouse in which environmental conditions, can, in large measure, be controlled.

Egypt has thus far developed only a modest export market for horticultural crops, and these markets are not stable. They fluctuate greatly from one year to the next. If Egyptian farmers are producing enough to supply the high levels of demand in some years, they are undoubtedly producing too much in other years when exports are significantly lower. We saw evidence of this in Ismailia in talking with several growers who said they had great difficulty some years in selling their strawberries and other crops for export.

Obviously, to be truly competitive in export markets, any country must consistently have available a high-quality product. This requires the development of a good system of grades and standards, handling procedures which do not damage the product needlessly, refrigeration facilities for storage and transportation, etc. To date, Egypt has done little in these areas. There is urgent need to take advantage of what would appear to be excellent opportunities in this area.

With the move towards privatization of agricultural operations, there is also a great need to develop effective storage and marketing procedures for commodities to meet domestic market needs. Officials point out that at harvest time, farmers flood the market with their product because they have no storage facilities and they need income as soon as possible. With farmers all over the country doing this at about the same time, prices drop precipitously. However, prices quickly come back up once the glut is gone.

We strongly recommend that steps be taken to improve and further develop both domestic and export markets for agricultural commodities to take better advantage of excellent production capacities.”

**Criticism of NARP and Response Thereeto**

NARP has received rather severe criticism from some sources, including a critical audit by the Regional Inspector General Cairo. This audit
resulted in a prominent U.S. senator in 1989 criticizing the project and expressing serious concern about the effort. This episode, and perhaps other incidents, caused USAID Washington and USAID Egypt to focus much attention on NARP, leading to serious questioning of whether the project should even be continued. There was, in fact, a major reduction in AID funding and a total cancellation of important parts of NARP and a reduction of its budget.

We were told by a senior USAID official that "many USAID and Government of Egypt actions, reactions, and responses that hindered the project can be traced back to the early negative history." There were also changes in leadership on both sides of the project (three USAID Mission directors, for example) as well as "changes in direction as natural responses to different leadership management styles and visions."

The assessment team feels that the problems and delays were apparently contributed to by both sides, and the burden of responsibility for these problems and delays does not reside with one party alone; both must share some of the burden. Frankly our team has had difficulty understanding why USAID’s commitments were drastically cut in the first place, given NARP’s obvious successes.

While there have continued to be implementation delays and other less serious administrative difficulties, which are undoubtedly irritating and frustrating to both parties, we believe minor difficulties should not be the source of undue concern and must be weighed against the overall outstanding accomplishments of the project."

**Research to improve efficiency and productivity in agriculture is never done!**

"We are fully in accord with the Government of Egypt’s Ministry of Agriculture’s major strategic goals for the agricultural sector, namely, to optimize crop returns per unit of land and water, to enhance sustainability of resource patterns and protection of the environment, to bridge the food gap and achieve self-reliance in agriculture, and to expand foreign exchange earnings from agricultural exports.

During the assessment team’s visit to Egypt, we were asked a very pertinent question by a USAID official: "If Egypt is making all these advances in agricultural production, why is there need to continue support for further research-related activities in agriculture. Isn’t this task now done so that we can move on to address other needs?" The simple answer to that question is that research to improve efficiency and productivity in agriculture is never done-never finished. As long as there are more human mouths to feed, there is continuing need for such research.

In fact, a significant amount of such research would be needed merely to accommodate the food needs of a stable human population. But neither
Egyptian nor global population is stable. In fact, over 90 million additional people are added to the world’s population annually, and Egypt’s rate of population growth of some 2.3-2.5 percent is above the world average of 1.6 to 1.8 percent.

Such constantly growing need resulting from population growth demands increasing levels of research—especially in situations like those found in Egypt where yield levels are already high. When a country reaches a very high level on the crop yield curve, as Egypt has, each additional increment of production may become more difficult to achieve.

But Egypt, because of its very limited arable land and water resources, is probably more dependent on research to expand food production that any other country in the world. Moreover, the primary beneficiary of such research is the consumer, who is served by having not only an adequate supply of food, but also higher quality and less expensive food as well. Therefore, the need for a high-quality, productive agricultural research program is vital to a sound economy and a stable political future. While much has been achieved through past support of agricultural research, much more effort is needed.

USAID projects have contributed immensely to improving the productivity of Egyptian agriculture for some fifteen years through their support of research, policy reform and other programs. NARP, we believe, has been a vital part of that effort for the past eight to nine years. However, because of the significant delays in the implementation of the project, along with major reductions in the amount of USAID financial commitments, there is still much to be done.

**Future Efforts in Research Should Include:**

- Expand research collaboration both internationally and domestically;
- Research on New Lands;
- Research activities for maintaining a sustainable agriculture;
- Breeding to reduce need for pesticides;
- Development of cultivars more tolerant to environmental stresses;
- Research aimed at producing more per unit of land and water;
- Public policy and data analysis;
- Market research and development—for both export and domestic markets;
- Further improve research infrastructure;
- Build on the experience of the Technology Transfer Component and continue...
• the improvement of extension;
• Restore cotton ginning capabilities for breeding work;
• Greater emphasis on research dealing with food animals;
• Greater effort on improvement of vegetable oil production;
• Continued support in genetic engineering and other areas of modem biotechnology research;
• Further development of the "Expert Systems" Program to be used by both
• extension and the private sector in technology transfer;
• Continued emphasis on human resource development;
• Consolidate and emphasize on-farm water management;
• Research to address long-term strategic goals

The team firmly believes that while great progress has been made over the past fifteen years or so through USAID assistance, there is continuing need to develop strong and sustainable capacity to accommodate further support for agricultural research and related efforts. This is especially true until there can be developed means for assuring adequate financial support from local sources—Government of Egypt and otherwise.

At some point USAID support will likely be greatly reduced or cease. Hopefully that will not occur until a much strengthened research capacity is developed and until there is better assurance that there is adequate support to maintain the capacity of such enhanced programs.

The national research effort in agriculture will likely be primarily dependent on future Government of Egypt funding. We firmly believe that agricultural research and related efforts should receive higher priority in such funding. Given past experience, however, there is little assurance that this will be adequate to maintain a vigorous research program. Therefore, we suggest two possible approaches through which funds could be generated to complement Government of Egypt funding.

We recommend that consideration be given to the development of programs to generate research funds through farmer assessments or contributions. For example, a possible approach could be one in which each ton of fertilizer or feed purchased and/or each ton of product a farmer sells is assessed a very small percentage of the value, with the funds so generated being put into a special fund to be used only for supporting research-related activities. The amount of the assessment would likely be no greater than one-tenth of one percent per ton—although different rates could be established for different items.

A "Piasters-for-Pounds program or something similar could be effective, with farmers realizing that they are investing very modestly in programs
that will pay them great dividends in terms of enhanced incomes resulting from the application of research results.

In addition to direct funding for current programs, we recommend that while the United States is committing large sums of money to Egypt, consideration be given to using some of these funds to establish an endowment, the proceeds from which could be used to provide continuing support for research-related activities.

Funds put into the endowment could either be in the form of U.S. dollars from ESF commitments or from local currency generated through PL 480, PL 416, or other U.S. programs. Funds from these sources could be put into a "special," nongovernmental foundation annually for several years through which an endowment could build up sufficiently to help assure that the progress made through current U.S. assistance could be sustained. The foundation into which such funds would be placed could be governed by a joint Egyptian-U.S. board, if desirable.

The U.S. government provides at least $815 million annually to Government of Egypt in economic support funding as the result of a program that grew out of the Camp David Accord in the late 1970s. It was primarily these funds that were used to support the research programs discussed in this report. The continuing question is "how can these funds be used most effectively?"

A very strong case can be developed for putting significant amounts of these funds into the agricultural sector. Agriculture continues to be one of the three most important segments of the economy. Over half the Egyptian people are engaged in farming or agriculturally related business/industry. Moreover, the agriculture sector has already enacted more reforms and has moved farther toward privatization than any other sector and is therefore better positioned to use U.S. assistance more productively than any other sector.

We believe that high priority should be given by the United States to supporting the agricultural sector. We further believe that, at this juncture, support for functions and needs we have addressed herein should receive highest priority in terms of future U.S. support."


CHAPTER 7
POST NARP PROJECTS

Strengthening agricultural development is a critical element of economic development. USAID’s strategy in Egypt aims at increasing the competitiveness of the agriculture sector by investing in systems that will support the production of goods that contribute to increased market share
in both domestic and international markets. USAID/Egypt works with numerous participants in agricultural development in Egypt with the following goals:

- to promote policies that support the ability of farmers and other rural producers to improve their production;
- to provide sound legal framework within which businesses can operate;
- to integrate small and medium farmers into the export sector;
- to enable scientific development of new and more productive varieties;
- to improve agribusiness responsible for processing products and assuring timely flow of agriculture inputs to develop new and profitable markets; and
- to provide schools and universities that prepare students for the skills needed in real life.
Agriculture-Led Export Businesses (ALEB)

One of the recommendations of the NARP review committee was to develop activities in market research and development for both export and domestic markets. In recent years, the demand for processed foods in major markets has increased the demand for convenience foods. Egyptian processed foods have been far from a major beneficiary of this trend; processed foods make up a tiny proportion of Egypt’s exports. ALEB was designed to provide technical assistance and support to Egyptian food processing companies, ancillary service firms, and trade associations. (8, 14, 15, 33, 64)

Its objective was to enhance global competitiveness and increase exports of processed foods in the following ways:

- by collecting, analyzing and disseminating market information;
- integrating new food processing technologies;
- improving adherence to international food quality and safety standards;
- enhancing marketing in line with consumer business skills;
- strengthening associations;
- and forming strategic alliances

How Did They Proceed

Industry and manufacturing is one of the key sectors to the Egyptian economy. In the last decade, manufacturing was transformed by the privatization of state-owned enterprises and reforms that encourage the private sector. USAID Egypt worked hand in hand with the Egyptian government to help clusters of specific industries improve their opportunities to compete in global markets. This is conducted through the collaborative efforts of the private sector and policy makers to strengthen the business environment, raise production standards, create buyer-seller market linkages and reduce or remove impediments to investments.

Industry specific assistance was provided for the food processing industry and ancillary industries (e.g., packaging, pest control, etc.) and associations to improve their competitiveness and help achieve sustainable export growth. USAID/Egypt through the Agriculture Led Export Businesses (ALEB) activity worked to help food processors and
service firms to improve and optimize their current processing, management, operation, quality, personnel and other systems, with an eye on improving product quality, production efficiency and, hence, exports of processed food products. USAID assistance was focused on five primary target product clusters: dehydrated fruits and vegetables, frozen fruits and vegetables, herbs and spices, juices and concentrates and pickled products. Assistance to the processed food industry included services to assist:

- Companies operating in the food processing industry improve their marketing, production, and management systems and to access financial services. These included providing sources of market information, tailored technical assistance in the areas of marketing and production economics, and packaging, labeling, and product development. USAID also sponsored study tours to trade fairs worldwide to introduce Egyptian exporters to new markets and form strategic linkages with importers and suppliers.

- Market Pulse Egypt (MPE), annual Situation and Outlook Reports in five commodity clusters, and Special Opportunity Focus Reports. These sources of market information assisted companies operating in the food processing industry to better orient their planning and marketing strategies to meet the demands of target markets. Technical assistance for the processed food companies was provided in the areas of marketing and production economics. In production economics, for example, USAID/Egypt provided assistance in all issues that influence a company’s profitability and ultimate success in the world market place, which includes marketing, food input supply, process operations, quality assurance, organizational structure, management, and business and strategic planning. Among the programs that were offered: ISO 9000, Hazard Analysis and Critical Control Points (HACCP)(64) and other programs that focus on HACCP prerequisites, such as pest control and sanitation.

- Technical assistance and training were also provided to service companies (pest control, packaging, cold storage, etc.), in order to enhance their ability to serve the processed food Industry, as well as to strengthen cross linkages between food processors and service companies.

- Further support to the processed food industry included developing resources for trade associations, assisting associations with developing strategic alliances, organizing study tours, training in policy advocacy and following up on market linkage and strategic alliance opportunities and helping ALEB’s client companies to pursue these opportunities.
What Did They Accomplish?

By the year 2004, ALEB had delivered technical assistance to 36 food processor and service firms. Technical assistance has been delivered on a variety of topics, including, new product development, organic certification, cold chain technology, and US food labeling regulations. ALEB have been working with six companies as a "pilot" group to receive technical assistance in implementing a quality program in their plants. As the original six companies complete their plans, emphasis and effort were shifted to other companies. It is worth mentioning that Hazard Analysis and Critical Point Program (HACCP) certification is an integral step to entering European and American markets. From March 2004 - June 30, 2004, ALEB conducted seventeen workshops on various technical subjects such as Internal Auditing and Environmental Regulations for Export. As of end of June 2004, ALEB conducted a study tour, bringing twelve participants to training in quality management, to Italy to give several Egyptian tomato processors the opportunity to see Italian tomato processing facilities, farms and tomato variety trials.

ALEB has also conducted study tour to the post harvest course at the University of California in Davis, field trips to packing houses, cooling and storage facilities, produce distribution centers, modified atmosphere facilities for transit and storage, and transportation terminals in California.

Via ALEB's website, the project also delivered key technical information. This includes a series of "toolboxes" on export standards; on HACCP implementation; on US nutritional labeling which it presented on a workshop on Package Labeling and Design and to the Chamber for Food Industries. ALEB also conducted a workshop at HEIA on Crop Varieties for the Food Processing Industry.

In addition, ALEB assisted four processors to procure commercial quantities of vegetables. The Seeds and Varieties program has brought several new products to the market, and other new products to the stage of advanced development. These include Pickled Gherkins (Hi Tadi company), Frozen Sweet Corn (Givrex, Farm Fresh and Farm Frites co.), Baby Artichokes (EgySpan; not new but lower cost of materials since the field yield is about double) and Whole Peeled Tomatoes (Harvest). ALEB has also worked with HEIA, on post-harvest issues. Thus far in 2004, ALEB has worked with ten local short term technical experts in areas such as HACCP, process measurement and personal hygiene for workers.

ALEB attempted to capitalize on Egypt’s unexploited export marketing potential, particularly in the European Union and the Gulf and Middle East. It addressed many of the competitiveness challenges that will affect Egyptian agriculture over the next decade. Moreover, as the skills ALEB
helped to develop in processed food exports move backward along the supply chain, they will more easily be transferred to producers who sell only domestically. High quality processed foods manufactured locally will help enable Egyptian processors to meet the growing demand from the domestic market and compete more successfully with imports, which are certain to increase with the advent of the World Trade Organization. Marsh (64) (FAO 33)(FAO 34)

**Food Export Council**

A more complete story on the new Food Export Council can be found in chapter 9, but the following excerpt sets the tone for its efforts:

"The FTC will be run as a demand-driven private business in every sense of the word," Berzi says, "with the overall objective of helping the Egyptian food industry develop into world-class exporters. We will tackle issues like accreditation, hygiene, food safety, technical assistance, testing and professional training."

**Agricultural Technology Utilization and Transfer (ATUT)**

With the conclusion of NARP, it was clearly recognized that much of what had been done in this program needed to be continued and expanded. Research had to be expanded in the areas of horticulture and field crops. Extension and technology transfer capability was still immature and needed improvement. New varieties were needed with improved resistance to pests; tolerance to environmental stress efficient use of water. Further it was clear that improved and expanded research in the basic sciences of genetics and biotechnology would be essential factors for such accomplishments. The project which was developed with USAID for this mission was Agricultural Technology Utilization and Transfer (ATUT). It was active from 1995 to 2002. (10,14,15, 32, 45, 48, 55, 85, 91, 99)

Specifically, ATUT aimed to: improve agricultural technologies in Egypt by identifying and transferring to the private sector improved horticultural production, post harvest handling and marketing technologies, by developing a carefully focused, improved collaborative strategic research program aimed at resolving the major constraints to increased productivity of selected staple crops such as rice, corn, wheat and fava bean, and by supporting the expansion of research and use of biotechnology.
Accomplishment In field Crops

From the records the authors have found, it appears that improvements in the horticulture area were the main focus, but ATUT was successful in improving yields in the field crop area. Income per feddan at LE 790 for rice, LE 686 for wheat, LE 499 for maize, and LE 1,197 for cotton. The Agricultural Policy Review Program has estimated gross operating margins per kilogram for fine green beans a LE 1.46 (higher than ATUT’s later projection because of a higher farm-gate price) compared with LE 1.12 for cotton; LE 0.94 for fava bean; LE 0.66 for New Land potato; LE 0.40–LE 0.490 for Valley potato, bobby bean, rice, and wheat; and LE 0.24 for maize.

Accomplishments in Horticulture

Selected crops which have a competitive advantage in export markets were identified and moved to commercial scale.

A product/market development system that provides a foundation for further growth has been established, but is not yet self-sustaining.

An effective mix of production, post-harvest, transportation, and marketing support were delivered to selected growers/shippers.

A reasonably effective association of growers, exporters, and export support organizations known as the Horticultural Export Improvement Association (HEIA) has been established, but is not yet self-sustaining.

Production and sales results for horticultural crops

Table grape exports grew from 1,200 tons in 1998, to 6,600 tons worth $22.2 million in 2001. Exports for 2002 are projected at 8,200 metric tons;

Fine green bean exports increased from virtually none prior to ATUT to an estimated 19,700 tons valued at more than $23 million in 2001-2002;

strawberry exports increased from a little more than 2,000 tons at $10.6 million in 1998-1999 to 5,600 tons worth $22.7 million in 2001 and to 6,300 metric tons in 2002;

Cut flower exports in 1999, the year ATUT started the cut flower promotion program, were only 4.5 million stems valued at about $500,000. By 2001-2002 the country was exporting 33.2 million stems worth $5.7 million;

Increasing area cultivated for melon export from the trial one-feddan with Africare in Wadi El-Said in Upper Egypt in 1997 to some 250 feddans. Around 70 percent of melons planted for export in 2002 were of the Galia varieties that were introduced by ATUT project. Two additional varieties: Charantais and Italian cantaloupe; Piel de Sapo were also successfully cultivated for export.
New varieties of mango were introduced in Egypt for export in the European Union (EU) market. These include: Tommy Atkins, Kent, Keitt, Sensation, Van Dike, Austin, Sell and other red blush or red color selections that are well accepted in the EU market.

Total exportable yields of horticultural crops were estimated to be about 50 percent of total yields with some 2,300 jobs created from this increased export production. It is expected that continued technical improvements will raise product quality to EU standards, and that production of EU and Persian Gulf export quality table grape and strawberry will increase significantly over the next 10 years—to:

- 67,500 metric tons of strawberry,
- 45,600 metric tons of table grape, and
- 960 million stems of cut flower.

However, there is a question about whether the target markets for these products will be of sufficient size to purchase these quantities. Egypt may reach its maximum market share of the identified cut flowers by 2006, of strawberries by 2007, and of table grapes and fine green beans by 2012. Of these, only table grapes appear to have domestic demand of sufficient size to absorb second grade fruit from excess export-grade production. The magnitude of these implications for Egyptian producers is such that the export market projections for Egypt developed using the unmet-demand model should be thoroughly reviewed as soon as possible.

**Critique of ATUT**

*Marketing*

While the production focus was valid and succeeded in significantly increasing exports. It was known that the primary constraint to expanding exports of the key horticultural commodities was their failure to meet export quality standards. The ATUT approach was to focus the project on upgrading production and on export sales, rather than marketing. Hence it became clear that this approach was short sited and did not adequately address the development of systems for gathering and disseminating market intelligence and for strategic market analysis and planning. In addition program coordination was lacking between ATUT and other organizations concerned with exports, such as the relevant units within the Ministry of Foreign Trade.

On the other hand, the project team assisted growers and exporters to identify and negotiate with buyers. These skills have been important in the growth of fresh commodity export sales. Because of the emphasis on sales rather than marketing, however, most of the larger growers and exporters did not have access to an adequate market intelligence system.
nor have they gained the capability for developing effective medium and long term strategic marketing planning capabilities.

Extension (Technology transfer) & Working groups

One of the most important deficiencies, however, was the failure to recruit and train local associates for the Ronco technical team. It was reportedly the original intention of the RONCO/ATUT subcomponent to employ local technical assistants to assist and be trained by the Ronco technical experts, in order to leave behind a trained cadre of local horticulture consultants.

The intensive, one-on-one service delivery approach pursued by the Ronco consultants has been largely responsible for the excellent progress made by their producer clients. This strategy, however, had the effect of limiting the scope of Ronco direct technical assistance and technology transfer to a very small portion of the total horticulture sector. The Working Groups were able to transfer technology to more industry participants, but their coverage was limited by the relatively small number of people involved in the groups and their part-time participation.

There were no explicit provisions in the project for a human resource development/training subcomponent. While producer responses indicate that the on-farm training approach utilized by the Ronco team and the Working Groups was quite effective, the project, and the industry, would have benefited from the application of a planned and organized human resource development effort.

The improvements in productivity and export capability engendered through project-supported technology transfers have been institutionalized by the project beneficiaries and are thus sustainable. Beyond this aspect, the primary vehicle for the sustainability of project initiatives is represented by HEIA, which has been nurtured and supported by ATUT. The fact that HEIA has progressively improved its industry service capabilities and reduced its dependence on ATUT is an encouraging sign in terms of the continued sustainability of project initiatives. (RONCO-83)

The Agricultural Policy Reform Program (APRP)

Governments must work with agriculture-based industry to minimize the difficulties of adjusting to increased competition when liberalization occurs. Globalization of the world economy is an established fact. Removal of trade barriers, increased foreign investment, and enhanced competition should be accepted with purpose, care and with ample safeguards, but accepted just the same. Since the 1980’s, the Egyptian
government has moved toward trade liberalization and a market economy especially through the agricultural economy. Agricultural reform began in 1986 with the Agricultural Production Credit Project followed by the Agricultural Policy Reform Program in 1996. (1,14, 15, 17, 18, 21, 26, 27, 30, 35, 37, 40, 50, 51, 59, 72, 80, 81, 86, 92)

The Agricultural Policy Reform Program has helped the Government maintain progress on liberalizing agricultural markets and remove policy barriers to private sector participation in agriculture. The government has moved from being the major actor in all realms of economic activity to a role of providing the legal and regulatory framework necessary for the private sector and to the support of market driven trade and investment.

This study documents the fact that policy reform is more than issuing decrees, passing laws, and promulgating regulations. Appropriate technical content is critical, but the process of change cannot be ignored. In support of the changes in roles and in achieving the benchmarks, APRP has contributed to results in the following ways:

- APRP provided technical expertise in analysis, international best practices, data collection methodologies, and training course design. Particularly important was assistance to the process side of reform in work shop design and facilitation, implementation planning / monitoring, awareness and dissemination.

- APRP served as a neutral broker between the Government and the private sector, and between government agencies. The various sets of actors remained confident that APRP was not taking sides, and thus were willing to listen to and follow APRP experts' recommendations.

- As a policy interlocutor with the Government throughout the elaboration of the benchmarks for the program's tranches, APRP helped to design implementation roadmaps, and facilitated legitimization of the benchmarks as targets.

- APRP's implementation reform support strategy, by working simultaneously at multiple levels (central to local) with many partners (public and private) and by building in some early successes, maneuvered around implementation roadblocks, showed stakeholders that change was possible.

- APRP successfully leveraged its resources and impacts. This contribution is exemplified by the collaboration with the German GTZ's Cotton Sector Promotion Program.
Results From APRP Horticulture

An overall picture emerges of positive and significant impacts of APRP technical and process assistance on all of the, benchmarks reviewed. The Government has taken steps to allow the private sector to play a larger role in pest management and extension services for horticultural exports. Through pilot efforts, public and private-sector actors are building new capacities to work together and to take on new functions in pest management, and research and extension for horticulture. Construction is underway of a cold storage facility under private-sector management at the Cairo airport. The ministries of agriculture and of foreign trade are providing more and better information to the private sector and are engaging trade associations in policy discussions and decisions.

The ministries of agriculture and of water resources and irrigation are cooperating in a new real-time irrigation information system that is improving the efficiency and effectiveness of Nile water use by Egyptian farmers. Trade associations and cooperatives have become more adept at mobilizing their interests, expressing their needs, and influencing agency behaviors.

Steps Toward Privatization Cotton

The GOE took several steps towards liberalizing and privatizing the cotton sub sector; however, a more comprehensive approach to liberalization is still needed. Despite the government’s efforts to liberalize the cotton sub sector, public sector textile companies are still struggling with high prices for cotton, which is the main input of production, amounting to 60% of the production costs. In addition, public textile companies are bound by the government wage and bonus system that entitles workers to an annual raise of 15% regardless of the company's sales and revenues. Thus public sector companies are heavily burdened by rising costs and decreasing revenues. It is very difficult to privatize the public textile companies under such operating conditions.

Encouraging imports of cheaper shorter-staple lint is one way to reduce spinners' input costs in Egypt. To this point, public spinning companies have obtained imported lint only through the Holding Company. If the Holding Company is concerned about burgeoning lint stocks and excessive carryover from one year to the next, it will not import shorter-staple lint even if it is priced far lower than the cheapest Egyptian varieties, Gizas 80/83.

The stagnation in the privatization program in the textile industry is in part due to the over all unfavorable market conditions; however, it is mostly due to the chronic problems that are plaguing the public sector
textile companies. These include excess labor, large accumulated losses, large bank debts, and most of all unmarketable output. High prices for Egyptian lint are a major handicap for public sector textile companies in the domestic market. After the devaluation, public sector companies have been able to capture greater domestic market share; however, they are still facing stiff competition in the export market. High raw material costs for Egyptian lint, redundant labor, and poor quality yarn hurt the international competitiveness of domestic spinners, particularly public ones.

Improving the quality of yarn products is key if public sector spinning and textile companies were to succeed in reducing their large inventories and improving their financial situation. Some observers argue that many public sector spinners spin too wide and too low a range yarn counts and should narrow the range and, if possible, increase the average count. Other observer's feel that most public spinners should concentrate on spinning low counts of yarn using cheaper, shorter-staple imported lint. Whatever strategy is chosen, it appears unlikely that significant funding will be made available for technical restructuring, particularly upgrading plant and machinery. Without such upgrades, the long-run validity of many public spinners can be called into serious question.

A comprehensive plan is needed to restructure the cotton and textile sub sector. Without dealing with the root of the problem, it will be difficult to privatize public textile companies. Note that CSPP and the High Cotton Council are leading a cotton sub sector strategy exercise that may attempt to define, more accurately, public spinning industry requirements. This strategy exercise is not, however, intended to address privatization issues. Nevertheless, developing a comprehensive strategy to deal with the sub sector’s problems and the underlying issues that hinder privatization would have a positive impact on encouraging private participation in the cotton and textile sub sector, which can boost the privatization program of public textile companies.

To facilitate the sale of ginning capacity, a necessary first step is to deal with the excess capacity in the industry. The GOE should start by implementing the unpublished Holding Company plan to close 13 public gins to reduce capacity to a more optimum level. This would likely allow ginners to charge higher rates, which could make ginning more profitable. Once made more profitable, public ginning companies would become more attractive privatization prospects. Higher returns would also allow ginners to invest more in improved ginning cleaning and baling techniques.

Finally the GOE moved in the right direction when it adopted the new strategy to privatize the loss-making companies. However, more
aggressive unbundling of public companies may be required to encourage their sale in the near future until a more comprehensive plan to restructure the sub sector is adopted.

In terms of APRP benchmarks, these results have produced clearly visible benefits regarding: a) state withdrawal from cotton pest management, b) promotion of trade associations, c) effective use of real-time irrigation system information, and d) improvement in agricultural statistics.

Benchmarks where some initial benefits have emerged or where there is high potential for future benefits include: a) reorientation of agricultural research and extension services, b) establishment of the private-sector operated cold storage facility at the Cairo airport, c) promotion of cooperatives, autonomy and functioning (including cotton marketing), and d) promotion of private-sector participation in policymaking.

**Performance of Public Textile Companies**

The overall performance of public sector companies has been deteriorating over time. In addition, the financial performance has been worsening at an increasing rate over the past five years between 1997 and 2001. In 1997 net revenues of the HC were more than LE6.3 million but fell by almost 54% to reach LE 2.9 million in 2001. Earnings before taxes for the profit-making companies declined by 54% as well while loss-making incurred an increase in losses by 30.7% over the same period.

In the annual report presented to the board of the SWRMC-HC at the close of FY 2000/01 the HC identified interest pa and wages for redundant labor to be the main reasons behind the continued poor financial performance. Excluding the non-textile companies, the HC burdened by LE 1 billion of accumulated interest payments in June 2001, up from slightly less than LE 900 million in 2000. In addition, the burden of redundant labor wages was up 4.4% from LE 226 million in 2000 to LE 236 million in 2001, with higher salaries off setting the lower number of workers. It is worth noting, however, that most of the burden and drain on the HCs resources can be attributed to the textile companies and their worsening performance over the past five years.

**Management Contracts**

In an attempt to prepare public companies for privatization, the SWRMC-HC sought the expertise of specialized management firms. Through the newly established Egyptian Company for Development of the Textile Industry, the HC is in the process of implementing and monitoring four
management contracts in Misr-Helwan S&W, Nasr-Mehalla S&W, Shourbagui, and and Cairo Artificial Silk. Unfortunately, the overall performance of these management contacts has not been satisfactory.

Privatization of Cotton Ginning Industry

Ginning industry privatization started in 1996/97 with the sale of Arabia Ginning and Nile Ginning. Both were majority privatized through the stock market, through small groups of investors quickly controlled a majority of the shares. The sale of other public ginning companies has stalled due to the high value of the land on which the gins are located. In addition, a large excess capacity exists in the industry and, thus, the private sector is reluctant to invest when ginning revenues and net returns remain low. At this point, the prospects of privatizing the remaining public ginning companies seem rather slim.

Both public and privatized ginning companies have implemented ERPs, through which a total of 540 workers were released from the industry at a total cost of LE 12.5 million and an average cost per worker of LE 23,190.

Post-Privatization Performance

The privatized companies, particularly Arabia Ginning have witnessed considerable technical and managerial improvements after the transfer of ownership to the private sector. Arabia's new management has improved seed-cotton cleaning and introduced full and partial mechanized feeding which resulted in a 35% increase in output per unit of time. In addition, a new quality control department was established to review ginning operations and ensure quality for exports. Arabia has also imported new ginning stands from India and replaced the equipment in a number of its gins. The new stands have the advantage of saving energy, as their power consumption is 15% less than traditional stands and their post-devaluation cost was 66% of that of the traditional English ones, including custom duties. Also, both Arabia and Nile Ginning have introduced new UD bale presses. Exporters can export lint cotton directly from the gins avoiding costly Farfarra (blending) and repressing in Alexandria.

According to the limited data available on the financial performance of privatized companies, Arabia Ginning witnessed a significant improvement in its financial performance with an increase in profits of 25.6% immediately after privatization. Arabia maintained the same level of profits into 1998/99. Nile Ginning, on the other band, recorded a decline in profits for the year immediately following privatization.
Privatization of Spinning and Weaving Companies

So far the GOE succeeded in privatizing four companies (Unirab, Alexandria Spinning & Weaving, KABO. and Bolivara), in addition to liquidating one company (Cairo Silk). Production units in four other public companies have been leased long-tenn (5-10 years) to private operators. Most of the privatization achievements took place between 1996 and 1998, and the progress in privatizing textile companies has been halted since 1999.

Privatization in the Rice Milling Industry

The privatization of the rice milling companies was completed in 1998/99, by which time the private sector had already invested heavily in new mills. Therefore, the privatization of public mills was of little interest to the private sector at that point which resulted in selling all 7 rice mills to Employee Shareholder Associations (ESAs). The rice milling companies were majority privatized with the ESAs having 90% of the shares and the HC keeping 9.9% of the shares. The remaining 0.1% was sold to individuals to ensure that the company qualifies as a shareholder’s company under the Egyptian Law.

Since privatization, employment in ESA rice milling companies dropped by almost 57% by early 2002. This drastic reduction in labor was achieved through both early retirement and regular retirement programs. At an average cost of LE 22.592 and a total cost of LE 70 million, the HC released 3,107 workers of the rice milling companies through the early retirement program (ERP).

Conclusions from the review conference held in July 2002

In a number of areas, reform progress has been steady but is still incomplete. There is a need for more work in cotton, cooperatives, pesticide licensing, registration of dealers, and field supervision and research and extension, There is serious danger of back-sliding on fertilizer use and supply. The wheat sub sector, particularly the milling industry, has significant GOE intervention, a set of policies that seem to work at cross-purposes, and an overcapacity problem that has gotten worse since APRP began. The immediate danger in rice appears to be past but there seems to be no real GOE support for a paddy buying system dominated by the cooperatives or forced through PBDAC sales rings, so little is likely to change in 2002/03. Greater paddy supplies, with a larger crop, should lead to lower paddy prices, easing criticism of private traders.

There are many critical issues associated with the production and marketing of cotton. Private sector market shares in cotton trading,
ginning, spinning, and exporting increased during APRP, but future gains will be difficult to realize without a renewed GOE commitment to liberalization and more active efforts to privatize public trading, ginning and spinning companies.

There were several comments about building local capacity to do applied policy research and extension. APRP is not generally perceived as having left much capacity in place, though it provided expertise in policy reform design, implementation, monitoring and evaluation. Such work continues to be heavily dependent upon expatriate-led technical assistance teams. At the height of APRP (mid-1998 through September 2000), there were ten expatriate advisors working in MALR and seven in MWRI.

Despite the acknowledged dependence on expatriate TA, no consensus emerged on how to lessen this dependence and develop sustainable institutional capacity. Different discussants preferred strengthening capacity in different types of institutions: GOE ministries, trade and industry associations, and local universities. Barring any radical departure from past practice, the current technical assistance model, where local consultants are hired from universities, a thin layer of consulting firms, agricultural research institutes, and among a pool of retired civil servants and holding company officials, is likely to prevail.

One way to strengthen the capacity of Egyptian universities would be to award competitive research grants to specific departments, under the leadership of strong individual academics. Rather than merely hiring professors as consultants, USAID and other donors could encourage interested academics to work in teams of professors (senior and junior) and graduate students, developing coherent proposals and work plans for doing a particular contracted piece of research. While this would place more burdens on USAID contractors to select grantees, competition would be introduced into academic consulting. A premium would be placed on the quality, feasibility and cost of particular proposals, rather than on seniority or academic prestige.

Another way to develop capacity to do market research and improve market information is for advocacy organizations to fund or co-fund such work. The stronger industry and trade associations need to develop their own capacity (and use their own funds) to gather, interpret and publish market information. Their willingness to pay competitive salaries (or consulting fees) to qualified professionals who can perform these services remains uncertain, however.

*Lessons learned*

A number of lessons emerge from the study:
The public and private sectors need to work together as partners to take advantage of each one's distinctive competencies/capacities.

Policy projects can serve as an important impetus for initiating change, and their budget support is a motivator for pursuing reform.

The Government of Egypt's gradualist implementation strategy has led to series of short-run successes, but some interpret it as ambivalence and weak commitment. For long-term benefits, reformers and donors need to "stay the course."

The demand side of policy reform is critical. Government commitment and ability to supply reform is enhanced by pressure from the private sector and civil society. Private-sector demand making capacity is not always used in support of intended agendas of reforms, but this is not a reason to abandon reform. Some degree of deviation from the ideal is to be expected.

When using pilots as an implementation strategy, scaling up is critical to generating intended program impacts. Key challenges include:

1. Marshalling the resources to facilitate the expansion
2. Coping with insufficient existing capacity to support scaling up
3. Confronting interest group politics, whose effects can to some extent be mitigated in pilots, which emerge more forcefully with scaling up.
Agricultural Business Linkages (AGLink) (3, 14, 15)

Started in 1996, agribusiness linkages for Egypt (Aglink) was a 7 year initiative which made an impressive contribution to transforming and strengthening the Egyptian livestock sector. It increased the quality and availability of milk and meat for local consumption, created a substantial rural employment base and stimulated trade linkages with the US. Aglink was awarded first place ranking for three consecutive years by Price, Waterhouse Cooper based on the number of recommendations adopted, services delivered and trade linkages facilitated.

What Did AgLink Do

Aglink increased the productivity, efficiency and sustainability of large commercial, medium and smallholder clients by providing technical assistance and training in basic technologies such as animal nutrition, health and farm management, trade development, association development and facilitating access to credit. By the end of year one, Aglink had successfully improved the efficiency and productivity of target farms and processors through the application of recommendations of US and local consultants coupled with seminars and training sessions that helped to raise awareness among targeted clientele and key stakeholders about the livestock industry as a whole.

The Egyptian meat and farm technologies association secured a bulk contract with feed supplier ROBY in Egypt for grain which it retailed to its members at reduced prices saving them 38 Egyptian pounds per ton. 2000 metric tonnes were purchased during phase one of the project. The Egyptian milk producers association reduced their feed costs by 15%, increasing the feed conversion rates by 22% and raised the overall firm capacity by 50% as a result of adopting four new practices and three new technologies. By implementing new silage technologies, the animal health cooperative, a diary production cooperative, computerized its record keeping and total mixed ration practices and increased its milk production by 30% from 6 to 7.8 tonnes per day.

Initial Conditions of the Industry

Animal husbandry and milk handling practices at the farm level were often inadequate or improper. For example, AgLink found such elementary production-inhibiting practices as feeding berseem before it was sufficiently dry and milking to the very last drop of milk. The project also found sanitation could be improved by raising the roof of animal sheds to permit drying of muck and by eliminating a practice of putting wet muck on the cow’s teats. In addition, feed rations are less than optimal; however, this is probably as much a question of affordability as it is lack of knowledge. This situation provides opportunities for significant low-technology, low-cost technology transfer, such as the
AgLink examples. These improvements will improve the quality of milk and red meat production, increase productivity, and reduce costs. Cattle and buffalo milk issues require an integrated approach to improve the entire sector—animal husbandry, on-farm quality, assembly transportation, and processing.

The livestock and poultry sector is traditionally highly integrated with the crop sub-sector. It was estimated that 40 percent of the total value of farm livestock production, in the form of animal power and manure, is a direct input to crop production and that 22 percent of crop products (mainly winter berseem clover) are direct inputs to livestock production. Therefore, the livestock sub-sector should be a main consideration in cropping decisions, and vice versa.

Not only is the livestock and poultry sector an important source of cash income to family farms, but of equal importance is the fact that the sector offers relatively higher opportunities for family employment. It was estimated, in the only available farm budget survey data, that the livestock sector utilized 40 percent of the total agricultural labor supply and 71 percent of female labor in agriculture (Fitch & Soliman, Livestock Economy in Egypt, 1982). Thirdly, it also benefits crop production by providing manure and draft power.

**Accomplishments**

A commercial livestock and poultry supply industry and a national marketing system are emerging for new products such as cheese, ice cream, processed meat, and packaged eggs. However, this industry is characterized by inefficiencies that are reflected in high product losses in milk, meat, and egg assembly and transportation; hatching chicks; and the handling of live birds. Such losses reduce volumes and lead to a reduction in quality and in producer prices. It is hoped that the Food Export Council of the Ministry of Trade and Industry (chapter 9) will be a help in improving the quality and market acceptance of these products. info@feceg.com

As a result, the Egyptian farmers benefited from:

- Increasing the importation of US Agricultural equipment for a total of $26 million dollars.

- Dramatic increases in sales among Egyptian agribusiness firms resulted in 24.5 million increased revenues and 66.15 million increased revenues among non-core clients.

- Long-term business relationships were established between Egyptian and US agribusiness firms and farmers as well.
Visits that Egyptian business people made to the US agribusiness firms resulted in new contracts signed between US and Egyptian firms valued at an average of $70,000 dollars for each.

The Egyptian milk producers association EMPA which was formed in 1997 had a mandate defined by the founders and members based on immediate needs particularly related to advocacy, input supply services and technical assistance for the members. In its first year of operation, EMPA successfully negotiated favorable prices for feed inputs such as cotton seed and molasses and actively lobbied for lower tariffs on grain. Aglink’s association and development activities focused on building capacity through the provision of training for management, the board of directors and general membership.

Problems still facing the industry

Livestock

Beyond the farm gate, there are constraints in assembly, transportation, and processing. The most serious are in milk assembly, where inadequate facilities reduce the incentive for farmers to increase production. This is true not only of GOE assembly facilities but also of private sector facilities. There has been some improvement in private sector facilities serving or operated by modern private sector processors that produce quality products. There are also losses in quality because of lack of refrigerated transportation.

The lack of standards in livestock trading is a disincentive to production of better livestock. Standards pertaining to weight classifications and meat quality and health (as gauged by appearance) would create a direct connection in the farmer’s mind between animal husbandry practices and income received for the farmer.

The slaughtering industry is in need of major improvements. There is major overcapacity, thus increasing per-unit costs of all in processing operations. Few plants employ modern techniques. These deficiencies are directly attributable to GOE investment in slaughterhouse facilities in the past. They overbuilt and do not have the money to modernize. The entire industry, and consumers, would benefit from a rationalization of the industry that would increase capacity utilization, thereby decreasing costs that could result in reduced prices to consumers and facilities modernization (which would also lead to reduced costs).

The GOE used to subsidize feed and feed ingredients and enforce low prices for manufactured feeds. This was accompanied by full governmental control on imports of ingredients and by quotas to feed mills. This promoted an inefficient industry in terms of productivity and profitability. With the removal of subsidies, a more efficient feed industry has emerged. In addition, the feed industry has received
technical assistance in producing lower-cost feeds from foreign aid projects.

The E.U.-sponsored the Animal Feed Quality Improvement Project developed the technology for treating straw and crop residues with ammonia and supplementation with molasses to increase feeding value. MALR extension staff disseminated these technologies and established eight centers for ammonia feed distribution in the Delta. The GTZ has supported the Non-Traditional Fodder Project in three villages. Its objective is to integrate crop residues and by-products in animal feeds at the farm level. Accordingly, MALR has implemented some extension packages. USAID’s AgLink, Africare, and CARE projects have provided direct delivery of technical assistance to livestock farmers.

**Poultry**

Commercial, industrialized, high-technology *poultry* systems produced 73 percent of all broilers and table eggs in 2000. The industry suffers from numerous problems, most of which are related to overcapacity in all areas—production, hatcheries, feed milling, and slaughter houses. Production, feed milling, hatching, and veterinary services are largely owned by large commercial operations. Questions were raised regarding the rationalization of the slaughterhouse industry regarding the privatization of GOE-owned slaughterhouses and feed mills.

**Livestock Health and Reproduction**

Livestock technical and veterinary extension services are provided through MALR’s livestock production departments and veterinary departments in the governorates. Critical disease control campaigns are ongoing. However, budgets are insufficient to provide adequate services. The European Union initiated a program in 1994 to support the privatization of veterinary services by strengthening institutions, providing training, pricing of services to farmers, and identifying public roles.

Artificial insemination services are also monopolized by the same MALR departments. These services are very limited. The total number of artificially inseminated cattle cows in 1999 was only 7.9 percent of total elder female cows and just 1.9 percent of total elder female buffaloes with positive results of 65-70 percent. The Canadian Animal Production Technology Project provides technical services in embryo transfer, artificial insemination, and animal health.

The Food Sector Development Program of the European Union has allocated LE 200 million to provide technical services, artificial insemination service, a dairy board, marketing-system development, data collection and market information, dairy quality improvement, and a credit line of LE 150 million for dairy farmers as a revolving fund to develop modernize and expand their operations. Another LE 50 million
has been allocated for training purposes on all levels. The program is limited in scope—20 villages in each of five targeted areas have been selected to date to receive these services. The International Development Research Centre (IDRC) of Canada has initiated a pilot project for developing a milk-recording system. The project has established a data-processing laboratory within the College of Agriculture at Cairo University that can handle data of 100,000 lactating cows. The FAO has provided a technical cooperation project for extending this center’s services into a full-scale national dairy herd improvement system, including executing genetic improvement programs, improving management practices of dairy herds, and developing a friendly-farmer-use information system.

**Common issues that need to be addressed**

**Finance**

Credit for small livestock farmers is offered through PBDAC. However, such credit is not available for those who do not own land or buildings to use as collateral. Loans for establishing commercial farms and importing stocks, equipment, and feedstuffs are also available. Producers are asking PBDAC to accept cattle as collateral and suggesting that this change can be accompanied by a special livestock insurance system to guarantee loans repayment. PBDAC interest rates are 11-15 percent, lower than commercial banks (12.5-14 percent) but higher than E.U. program loans (6.5-8.5 percent) and social fund loans (7-9 percent).

**Policy**

The meat and dairy-processing industries need to be rationalized, closing inefficient plants and encouraging complete privatization of Dairy and slaughterhouses and feed mills for poultry feed and livestock.

**Credit**

Smallholders need credit to upgrade herd quality and size and to purchase milk-holding equipment that preserves milk quality. Assembly operations, existing and new, need credit to upgrade/establish their facilities and to acquire refrigerated trucks to transport milk to processing plants. Processors may also wish to use credit to purchase refrigerated trucks. Such a credit program would provide a significant market for sale of U.S. manufactured equipment.

**Animal Health and Reproduction**

A two-pronged approach is needed here. MALR capabilities should be upgraded and a private sector capability should be fostered. Both would be assisted by changing MALR’s policy of no- or low-cost provision of animal health products and artificial insemination to one of at least covering the full cost of materials used. Industry suppliers and
Veterinarians should be used to train other veterinarians as industry trainers in disease prevention and treatment. Financial support and commodity credits could be used to fund herd upgrading through artificial insemination and importation of pregnant Holstein cattle and dual-purpose breeding bulls.

**Feed**
The feed industry needs technical assistance to increase operating efficiency and feed quality. Concentrate feed grades and standards should be strengthened and enforced. The feasibility of providing commodity credits for feed ingredient imports from the United States should be explored.

**Industry Groups**
Producer associations, cooperatives, and industry associations have the potential to provide members collective services. Many, however, need assistance in the basics of association management and in coming together as associations to procure products and services, lobby the GOE for needed changes in policies and regulations, and develop new services their members will use.

**Market Information**
Deficiencies in the system of collecting and disseminating market information to farmers should be identified and the existing system strengthened using governorate MALR offices, producer associations, cooperatives, and other means to better disseminate information to farmers.

**Agricultural Exports and Rural Income (AERI)**
AERI began in the last quarter of 2003. It builds on USAID/Egypt’s previous efforts and focuses on:

- increasing agricultural incomes to stimulate rural off-farm employment, especially in Upper Egypt;
- improving the productivity and competitiveness of smallholders to achieve increased incomes;
- broadening horticultural development efforts to diversify crops and markets,
- enhancing the role of small growers as suppliers to exporters,
- integrating the fresh and processed segments of the industry,
- expanding the use of good agricultural practices in horticulture;
- improving the smallholder livestock sector as a means to increase agricultural incomes, especially for women who dominate this sector; and
- bringing about world class research and training that is more responsive to private sector needs.

As of March 2005, AERI through the small horticultural activity trained about 6,119 small and medium growers, in 88 training events, to increase their capacity to respond to market opportunities. Training and workshops programs included preparing farmers for production, harvest and post-harvest handling of green beans, melons, medicinal and aromatic plants and drying and oil extraction of both essential and aromatic oils. AERI is also working through the small dairy and livestock activity on improving smallholder product quality and volume. Current efforts include providing technical assistance to Small Farmers Groups includes training sessions, seminars, video presentations, direct consultations and business linkages. Training is provided in: (1) animal herd management, (2) animal nutrition, (3) animal health care and (4) dairy processing. (138)

As of March 2005, a total of 4,806 participants attended 191 training-days. Further, AERI through ‘Support to Trade Associations and Smallholder Groups activity’ works to strengthen the capacity of smallholders in Upper Egypt to expand into new markets for horticultural and livestock products through improved linkages with agricultural trade associations, and improved market development support by those associations. Thus, AERI works to provide flexible and appropriate technical assistance and grants to support agriculture trade associations that are of critical importance for expanding volumes of high quality agriculture products (dairy and fresh/processed horticulture) for export and the domestic market.

As of April 2005, USAID/Egypt evaluated and approved fourteen grant applications for the following:

- two feasibility studies related to grants for the construction of the Luxor post harvest facility and microbiological laboratory;
- grant to HEIA’s Cairo Air Terminal expansion facility;
- technical assistance for implementing a "Total Quality Management" system for the branding of cut flowers;
- feasibility study for re-organizing the HEIA training department; and
- two grants to the Food Processors Export Association.
In addition, AERI through the ‘Institutional Linkages Activities (ILA)’ works with research biotechnology institutions in order to strengthen Egypt’s capacity in biotechnology research and its application. Efforts to promote market relevant research resulted in approving six proposals for applied biotechnology research. The proposals were selected by the Biotechnology Advisory Committee.(138, 139)

**Growth Through Globalization project (GTG)**

The main purpose of Growth through Globalization project (GTG) (1996 - 2004) was to promote the competitive efficiency and exports of the private sector entities working in labor intensive products (US$ 133.5 million).(140))

GTG efforts included strengthening trade linkages between Egyptian and overseas businesses and connecting Egyptian firms with international trading partners. This was achieved through various services such as trade fairs, trade missions, study tours, the marketing correspondents’ network and the business matchmaking service.

Technical assistance to farmers was carried out by implementing a capacity building strategy that focused on building the marketing, technical, and financial capacities of farmer associations within a sustainable farming environment. Office equipment such as computers and fax machines were provided to the farmer nongovernmental organizations (FNGOs) depending on their needs, capacity and level of export activity. Additional support included the provision of packaging materials in order to improve the quality of their products for the export market. The FNGOs utilized this equipment, especially computers and printers, in producing promotional materials – brochures- which included information on their mission, vision, activities, and contact information. In addition, farmer associations learned how to use computer technology to analyze their production and marketing problems. Some of them worked to develop their own websites.

In order to optimize the marketing and technical assistance, USAID/Egypt emphasized the importance of investing in human resources. Training was provided through the ‘Agriculture Reform’ activity for board members of FNGOs’ on conducting Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Training was also provided for top management of member farms and companies on Good Agricultural Practices (GAP) specifications.

There was also an effort to bridge knowledge through adaptive research by collaborative research on four food crops (rice, maize, wheat, and fava beans) among U.S., Egyptian, and international research institutes. That resulted in the introduction of biotechnology techniques in breeding
programs, the development of DNA markers for bread wheat and a molecular marker map for durum wheat. (AGERI--7)

The AgReform Project—CARE

AgReform is designed to increase incomes among economically marginal farm households in Upper Egypt by improving their access to new markets and appropriate new agricultural production technologies. AgReform, initiated in the governorates of Fayoum, Sohag and Qena, in March 1996, continues to use the FarmLink Project strategy (1990-95) that directly links community-selected innovative farmers to sources of agricultural information. AgReform is based on the FarmLink experience, and has adopted most of its concepts, terminology, approaches, and data collection instruments. FarmLink successfully pioneered a participatory linking approach to agricultural extension in the horticultural sector.

As of September 30, 2001, AgReform has worked with 6,320 community-selected innovative farmers to create linkages that improve agricultural practices, 7,928 small farmers through the strengthening of 111 local agricultural and marketing groups, and the enhancement of local livestock services for 4,250 small livestock producers. In addition, the project collaborated with local government agencies in each governorate to enhance and strengthen the extension services’ capacity to better meet the small farm household’s needs and to manage and replicate AgReform activities beyond the life of the project. 292 Government Extension Workers have been involved in the project. In 2001, the AgReform grant was amended to add the farmer NGO component. To date, twelve farmer NGOs have been created and training is being provided to strengthen their capacity to coordinate the dissemination of marketing information for exports.

Center for Business Support—(IESC)

In June 2000, IESC was awarded a three-year USAID grant of $7.7 million to manage the Center for Business Support (CBS) in Egypt. The CBS program works with companies in three sectors: Information Technology, Tourism and Agribusiness. It has been working with companies in the food-processing sector since the program’s inception. Client companies receive subgrants to acquire technical consultants, attend trade shows, participate in trade missions, and develop websites. In the agribusiness sector, it has completed one major food processing trade mission event in cooperation with the USAID-funded Agriculture Led Export Business (ALEB) program. (8, 141)

Egyptian Exporters Association (EEA)
The EEA, and its operating arm, ExpoLink, is the successor to a long line of private sector general export promotion organizations funded by USAID. In previous incarnations it was known as the US Export Promotion Organization (USEPO) and the Trade Development Center (TDC). It provides services to firms in most of Egypt’s export-oriented sectors including IT, apparel and textile, furniture, fresh and processed foods, footwear and tanned leather, and marble. ExpoLink prepares firms to exhibit at international trade shows, provides technical assistance consultants, disseminates market information, prepares company literature and, latterly, advocates for policy reforms. The organization reported the following achievements in the agricultural sector during the period from 1997 to 2001:

- The total number of agriculture-sector clients served since the inception of EEA in October 1997 to June 2001 was 522.
- The total number of fresh and processed foods clients served since 1997 was 142 (27.2%).
- The total number of clients served in the fourth year was 64.
- The total number of fresh and processed foods clients served in year 4 was 14 (21.9%).

The type of information disseminated to fresh and processed food clients included new regulations for importing meat into Saudi Arabia, markets for herbs and spices in Malaysia and Indonesia, honey and honey wax in Holland; dairy and meat products, beverages, soups and dry mixes in Poland and Romania, herbs and spices in Japan, and the organic market in Europe. (142)

While EEA is an association in the legal sense, it did not begin to operate as an association until relatively recently. Now it is actively working to build membership, though there is no evidence of members voting for the Board of Directors.

**CRITICISMS of EEA:**

In a 2000 evaluation, the organization was criticized for:

- lack of transparency, and for deploying a disproportionate amount of its funds on trade fair participation, while not taking advantage of other marketing tools;
- quality of its market information and delivery mechanisms;
- lack of either sector-specific or general hands-on export experience among many of its staff;
- clients found EEA services too expensive and of questionable value.
- While policy advocacy was part of its Grant Agreement, it did little in this area
• The organization has in the past concentrated on larger companies over medium and smaller companies.

**IMPROVEMENTS of EEA:**

However, there are now positive signs that EEA is gradually correcting a number of these shortcomings. This is reflected in the most recent Client Satisfaction Review, where a preponderance of EEA clients expressed satisfaction with the services they received. Further, EEA is now becoming more positive—and transparent—in its policy advocacy activities. An example is a recent seminar on Customs Service Reforms attended by Customs Service officials, and senior USAID representatives. EEA has also begun to set up a network of representatives in major export markets; their task is to feed market-level information to EEA, which, in turn, makes it available to their clients.
Over the past two decades, numerous achievements have been realized, including the development of new varieties, improved agronomic practices, livestock development, maintenance of the national herds and better food processing techniques. While Egypt has gained a much better understanding of soil and water systems in the developing world over the past few decades, too little of this new knowledge has been successfully applied to many fundamental management problems. A continuous effort to maintain a solid scientific base of applied science and a strong extension service is essential.
CHAPTER 8
EGYPTIAN RESEARCH FOR AGRICULTURE TODAY

Egypt is an intensive user of modern technologies to improve agricultural productivity in an environment of scarce natural resources and population pressure. At the beginning of the 20th century, with this in mind, the Ministry of Agriculture (MALR) proceeded with the established technical divisions with research capabilities. These endeavors culminated in the creation of the Agricultural Research Center (ARC) in the early 1970s. (5)

Over the past two decades, numerous achievements have been realized, including the development of new varieties, improved agronomic practices, livestock development, maintenance of the national herds and better food processing techniques. New crops and animal breeds have been introduced and research has been dedicated to problem-solving, side by side with basic science. The overarching goal has been to maximize the economic return per unit of land and water. The Center has so far implemented four 5-year plans and initiated the fifth 5-year plan (2002-2007) in July 2002. Within the national agricultural development strategies, ARC assumes the following major functions:

- Conduct applied and basic research to generate a continuous flow of technologies that help increase productivity and reduce production cost;
- Transfer of new technologies to the farming community through extension service; and monitoring their adoption by the end users; and
- Human capital development as a continual process.

According to its Founding Law, ARC is required to develop its infrastructure, set its priorities, train its research personnel and support staff and upgrade its physical capabilities, with a view to achieving greater sustainability. Over the past two decades, ARC research personnel have increased from 1720 researchers in 1982 to 4300 researchers in 2001. New Central Laboratories and Institutes have been added to improve performance in the on-going plan which is built on the following pivotal themes:

- Sustainable development of research and extension capabilities;
- Upgrading technology transfer channels; and
• Utilize, to the maximum level possible, the findings of science and technology developed abroad.

The fifth 5-year plan incorporates 14 research programs, being implemented by 16 Institutes, 13 Central Labs, 10 regional stations, 36 specific research stations, 21 research administrations throughout Egypt and 4 research, extension and training centers of excellence. This effort is further supported by other partner agencies in MALR, Ministry of water resources and irrigation (MWRI), universities and sister research centers.

A multidisciplinary approach is the major feature of the current plan and key to its success. Clearer definition of research topics, geared to solving specific problems, is also another feature, complemented by the set objectives and the physical, human and financial resources earmarked to attain them.

The following topics are particularly appropriate in Egypt’s effort to increase food production and jobs for labor through efficient management of natural resources, especially water and fertilizer; selection of appropriate crops and varieties; care and improvement of animal productivity and the adaptation of products for foreign and domestic markets. The discussions include reports and examples of systems that have been used in Egypt or in other parts of the world to advance productivity, improve varieties, healthier products, more efficient use of resources, increase trade and financial stability, develop international markets and utilize the most modern scientific systems. These examples are intended to provide information for comparison with local situations and interests. They are not intended as “the way things should be done in Egypt.”

Section 1—Soil and Water Research

One of the challenges the world faces in developing agricultural strategies that are truly sustainable is maintaining the resource base--the soil and water that make agriculture possible. (16, 51, 107)

Population growth, intensified land use, environmental degradation, and agricultural productivity are interrelated issues. During the last 20 years, agricultural technology has been able to meet the needs of a vastly larger and generally more prosperous world population, but now there is concern that those initiatives have peaked and that the technologies in use focus mainly on the geographic sites with ample water and few soil constraints.

Meeting the world's increased needs and expectations continues to require concerted effort. Research is necessary on at least three fronts. First, techniques must be developed to intensify use of good quality lands while minimizing environmental degradation. Second, ways must be
sought to enhance production on lands previously viewed as "marginal" or "ecologically fragile." Thirdly, new emphasis must focus on restoring degraded lands while expanding the effort to extend these technologies to the users.

The Extension of Knowledge

The US National Research Council (NRC) Committee on Soil and Water Research and Development has concluded that while we have gained a much better understanding of soil and water systems in the developing world over the past few decades, too little of this new knowledge has been successfully applied to many fundamental management problems. There are substantial gaps in our basic understanding of the ecology of these systems and of the social complexity inherent in resource use.

The most compelling theme that emerged during their study was the need for better integration of soil and water research with other elements relevant to natural resource management. Soil and water practices are not independent endeavors, but rather must be an integral part of a larger landscape management. Our understanding of the basic principles of soil and water processes is fairly good, but our ability to apply this knowledge to solve problems in complex local and cultural settings is weak. The single issue research approaches of the past brought great benefits, but the problems we face are changing and demand a more holistic vision.

Two key indicators of deterioration in agricultural systems are declines in the quality of the soil and of the water. Poor management of either of these resources quickly leads to decreases in farm productivity. Most developing countries occupy tropical zones ranging from seasonally arid to humid tropical environments. Agriculture in tropical environments faces different constraints than in temperate regions, and this affects soil and water research needs.

Areas Needing Research

Given the problems faced by tropical agriculture, the unique characteristics of the environments and cultures, and the strengths and weaknesses of the existing data base, research in the following six areas could offer great rewards in support of sustainable agriculture and natural resource management:

- Overcoming institutional constraints on resource conservation;
- Enhancing soil biological processes;
- Managing soil properties;
- Improving water resource management;
- Matching crops to environments; and
- Effectively incorporating social and cultural dimensions into research.
To further these goals, the wealth of time-tested indigenous knowledge that exists needs to be tapped. Special potential lies in the blending of traditional and modern knowledge. One of the most intractable problems yet to be faced is the difficulty of communicating new ideas to the farmer and establishing two-way communication between farmers and researchers. After all the farmer knows what his/her problems are, but needs the scientists to help solve them and then in turn teach him to use the new techniques. Without this cycle, little progress can be made. Research and development organizations have struggled with this problem for many years, and it remains a high priority issue.

An Integrated Research Strategy

A collaborative, integrated research strategy requires institutional mechanisms and structures that effectively link research efforts and organizations with clients, and that enhance the interactions among the different components of research. Mechanisms are needed to reassess research priorities periodically and to generate local data about soil and water resources.

A basic issue in any attempt to target research to the needs of users is the pattern of communication and feedback among the different people involved. The chains of communication can be complex. Traditionally, crop research went through a hierarchical sequence from basic research to field testing to extension-agent promotion. But this structure has not always worked in developing countries. Special efforts are required to encourage networks, "intermediate change agents" (e.g., private voluntary organizations), and other mechanisms to link researchers and research organizations with universities in host countries, private voluntary organizations, village organizations, and farmers in interactive exchanges. Participation from the ultimate recipients of research, the farmers, is needed throughout the process of planning and conducting research. For this concept to work it is essential that the educational gap between the "agent" and the farmer be minimized. The farmer or end user of the new information must have enough education to comprehend the process being introduced.

Conclusions From the United States

The following are some common themes crystallized during the deliberations of the National Research Council of the United States:

- Major gaps still exist in our understanding of soil and water systems and processes, but more important are the gaps between what is known and what is applied.
- Indigenous knowledge should always be assessed. It often can suggest promising research on ecosystem components and strategies, such as nitrogen fixing trees, nutrient accumulating species, and low
input irrigation techniques. In some cases, it can provide a platform for the integration of traditional and new technologies.

- More effective links between the social and the natural science aspects of soil and water problems are needed. Social and economic contexts create constraints that can effectively limit the application of technical improvements unless such contexts are adequately understood and addressed.

- More effective ways to use research resources for long-term, practical ends are needed. How can better feedback and communication be established between the field and the research institution so research can be focused on real, practical problems?

- The weakest link in the research process is the dissemination of research findings to the farm or regional levels, with the great physical and human diversity that occurs. Greater effort is needed to develop better ways to communicate results.

Soil and water resources provide the foundation upon which agriculture is based. But successful agricultural production systems require a combination of biological and societal resources. This is a complex and dynamic mix of variables. In view of the evolutionary nature of agricultural systems, it is important that the setting of research priorities be an ongoing process. Research priorities must be reassessed and adjusted periodically to serve the problems at hand. A mechanism is needed for evaluating and reiterating priorities to keep them fresh, flexible, and responsive to current needs.

An effective effort to build sustainability into our agricultural systems will require changes in the philosophy and operating procedures of development organizations. Program planners and implementers will need to be more responsive to the evolution of individual agricultural systems and to the broader aspirations, needs, and capabilities of the user populations.

The search for ways to achieve sustainable agriculture and natural resource management will require changes in our traditional approach to problem solving. Researchers must cross the boundaries of their individual disciplines; they must broaden their perspective to see the merits of indigenous knowledge; and they must look to the farmer for help in defining a practical context for research. This change in vision is under way in various degrees throughout the research community, but the pace of change is slow. (143)

**Current Soil and Water Research in Egypt**

The Soil, Water and Environment Research Institute in Egypt is an important center focused on carrying out the research needed for the
critical areas of soil and water management. The following list of their activities describes their present day directions:

- Producing soil classification maps including soil productivity.
- Using remote sensing techniques in estimating urbanization and sand encroachment on cultivated soils, sea shore erosion and yearly census of cultivated crops.
- Irrigation water management through laser leveling, long furrows and gated pipes. Evaluation of the re-use of marginal water in agriculture.
- Environmental impact assessment of some agricultural projects.
- Evaluation of the use of slow release fertilizers as well as rock phosphate in agriculture.
- Recycling of agricultural residues to produce organic fertilizers.
- Producing bio-fertilizers for crops, bio-pesticides to control nematodes as well as bio–soil conditioners for the newly reclaimed soils.

It appears that the priorities in this area of emphasis are appropriate and in accord with the suggestions of the academy. However the lack of any emphasis on extension of the resulting information continues to be the major problem for Egypt and the region associated with the use of the Nile waters. Links with the farmers to better understand how they are managing their soil and water and to acquaint them with alternative and improved methods is essential. Also we know there are serious water pollution problems faced by agriculture in the Delta that need work.

Section 2—Cotton Research

Historical Background of the Cotton Research Institute

The Cotton Research Institute (CRI) is one of the oldest agricultural research institutions in Egypt and one of the pioneering cotton institutions in the world. Its roots are traced back to a small research station in Giza, founded in the first decade of the twentieth century. The year 1920 marked the beginning of serious coordinated research on the cotton crop under the umbrella organization known as the Cotton Research Board (CRB). Early research focused on the botany and genetics of Egyptian cotton, followed later by the selection of promising varieties. The spinning mill was built in 1935, and was separately responsible to the Ministry of Agriculture, but its day-to-day work was conducted in a close liaison with the cotton breeders. The spinning mill provided the breeder with the measurements and interpretation of fiber and yarn properties needed for the breeding program. Later on, the various sections dealing exclusively with cotton were reorganized into two separate sections. The Production Section included breeding, regional evaluation, variety maintenance, cultural practices, and
physiology. The Technology Section included fiber, spinning, grading and ginning. In 1971, the ARC was established to encompass research activities of the MOA, and the Production and Technology sections were joined into what is now known as the Cotton Research Institute.

The Cotton Research Institute Today (37)

CRI consists of a research staff of 157, plus a strong support staff. It is composed of two research branches, Cotton Production and Cotton Technology, and one directorate, Foundation Seed, which supervises the production of foundation seed lots. The research goals of the CRI are the following:

- Breed new varieties of high yield and quality Egyptian cotton to satisfy the requirements of local and foreign Spinners.
- Create new pest resistant varieties of cotton that have a higher tolerance to soil stresses and a shorter growing season.
- Maintain the purity of commercially grown varieties.
- Identify optimal varieties, with regard to yield and quality, for each growing location.
- Determine the best agricultural practices to optimize inherent yield potential.
- Improve quality assessment methods and annually evaluate the spinning properties of the commercial yield.
- Define the quality parameters of lint cotton grades for the benefit of cotton marketing. Refine cotton ginning techniques.

As we will see in more detail in chapter 10, cotton research has for over 20 years only maintained yields. Yields have not surpassed the levels of the early 1980s. The rest of the world has experienced steady increase in cotton yields. To catch up with the current Israeli level of cotton production is not possible with a business-as-usual approach to cotton research. Considerably greater focus and expenditure are needed. The present research system has been effective in maintaining yields in the face of the usual forces tending to reduce them. It must now focus additionally on what is needed for rapid yield increase.

"Reclaiming the cotton throne To rule as king once again, the Egyptian cotton industry is in dire need of an overhaul" reports Mona El-Fiqi, Cotton production Issues Today -- Al Ahram

"Egypt's "white gold" continues to face several challenges which have led to an obvious deterioration in its status on the international market. Experts believe that unless the government takes serious steps to recover the reputation of its cotton crop by increasing production, introducing new cotton varieties, reducing costs and implementing a clear pricing policy, this bullion will lose its allure."
The most pressing problem facing Egypt's cotton crop is dwindling land areas on which it is grown. According to Minister of Agriculture and Land Reclamation Amin Abaza, there are 450,000 feddans available for cultivating cotton -- a far cry from the two million feddans of cotton harvested in the 1950s. The reason behind the decrease in land area is that farmers are no longer interested in the crop because of inconsistent pricing policies.

Cotton prices fluctuate according to international value, and since the government does not provide farmers with financial insurance for their crop they turn to more reliable crops such as rice, vegetables and fruits. Since 1994, when domestic cotton trade was liberalized, the government is no longer responsible for marketing cotton, leaving farmers without any financial insurance on their harvest. Moreover, farmers cannot face the challenges of international markets and the sudden changes in prices.

The solution, according to experts, is a more effective role by the government in marketing cotton. "The Ministry of Agriculture should set an average price for cotton and announce it at the beginning of each season," suggested Hussein Mohamed Hegazy, chairman of the Shura Council's Agricultural Production and Lands Reclamation Committee. "This will help farmers feel secure and encourage them to grow cotton."

Another challenge is delayed payments to cotton growers, sometimes for months at a time. "Farmers in Beheira did not get paid for last year's cotton crop until July 2007, while the new harvest will be collected in October," revealed Hussein. "Understandably, a large number of farmers stopped growing cotton."

What compounds the problem is that most local spinning and weaving companies do not use Egyptian extra-long cotton, but prefer to import cheaper short-staple cotton. Hegazy asserted that it would be better if local manufacturers upgraded to the extra-long varieties, rather than concentrating on producing cheap garments. "Growing long-staple cotton but not using it in local factories weakens our position on the international market," warned Hegazy.

To promote the cotton harvest, Hegazy suggested that the government double the land allocated for cotton, part of which will be earmarked for growing the short-staple cotton needed in local production. The yield of the longer staple variety will target foreign markets since it is in high demand there.

Hegazy stressed the need to use advanced technology and genetic engineering to develop more productive varieties. Six countries, namely the US, Russia, China, Pakistan, Brazil and India, were able to increase their cotton production to reach 78 per cent of total world production by using advanced technology.

Another setback cited by Hegazy is that fertilizers, seeds and harvesting costs are too high, which put final prices above the international market.
value causing Egyptian cotton to lose its competitiveness. He urged that the government provide farmers with production needs at reasonable prices, as is the case in many other countries. Also, that the results of research on agriculture should be applied rather than shelved. "Although government research centers do a good job on cotton crops, farmers have not been informed of any of the results in order to benefit from them," stated Hegazy.

While agreeing that there are many serious problems facing the Egyptian cotton industry, cotton dealers put in a few of their own suggestions. Amgad Hassan El-Atal, chairman of Egycot and head of the Exporters Committee at the Alexandria Businessmen’s Association, believes that the most important problem is the government's sudden decision a few months ago to stop growing a long-strain variety of cotton, known as Giza 70, which is highly demanded by international markets.

El-Atal blamed the government for taking a sudden decision without informing cotton dealers beforehand, or providing other varieties before the moratorium on Giza 70. The Ministry of Agriculture had said the decision was a result of a poor harvest of Giza 70 due to mixing different cotton seeds. But El-Atal called on the government to introduce other longer varieties such as Giza 70, and find solutions to save other cotton staples such as Giza 88. "The ministry has to study well the reasons behind the decline of Giza 70 to save other cotton varieties," he urged.

One more problem, according to El-Atal, is the lack of set cotton pricing. He suggested that the government announces an estimated, non-obligatory price for all those in the industry, including farmers, traders, spinning companies and exporters. At the same time, this expert opposes subsidies or any other form of government support to public sector spinning and weaving companies. El-Atal explained that these companies will rely on subsidies and buy up large amounts of cotton in order to control prices.

In response to the cotton debate, officials promised that a number of procedures will be taken to help Egyptian cotton back on the right track. Abaza, for example, announced that his ministry is currently conducting a study to reduce the cost price of cotton by using high technology, particularly in collecting the cotton harvest. Abaza added that a number of new factories using long-staple varieties were recently established in the city of Borg Al-Arab. As a result, it is expected that there will be an increase in demand on Egyptian cotton and a rise in the area of land dedicated to growing the crop.

Also, the Ministry of Agriculture recently announced that it is considering to provide cotton farmers with production needs -- such as seeds and fertilisers -- at reasonable prices, depending on the number of feddans each farmer grows. This would encourage farmers to grow cotton, while at the same time lets market prices be decided according to supply and demand.”
Future of Biotechnology in Cotton Production (112)

Since the first report on cotton biotechnology in 2000, the adoption of biotech cotton has been rapid. According to the International Cotton Advisory Committee (ICAC), 21% of the world cotton area in nine countries was planted to biotech cotton varieties in 2003/04 representing over 30% of world production. The technology itself is also evolving with many new developments and possibilities for the future.

This second report aims to provide a balanced treatment of the issues associated with biotech cotton by updating the first report and specifically addressing biosafety issues surrounding biotech cotton, and the potential benefits and challenges for biotech cotton adoption in the developing world. For the purposes of this report the Expert Panel decided to use the generic term “biotech cotton” to describe varieties previously described as GM, GMO, or genetically engineered (GE), because the majority of the panel believes that the application of modern biotechnology tools is resulting in an expanding number of products best described by the term “biotech cotton”.

Global Status of Biotech Cotton and Future Prospects

Adoption of biotech cotton varieties has been rapid with the total global area of biotech cotton reaching 7.3 million hectares in 2003, grown in nine countries and representing 21% of cotton planted globally. More than 85% of the 7 million farmers utilizing biotech crops in 2003 were resource-poor farmers planting Bt cotton, mainly in China (Mainland), India and the Makhathini Flats region of South Africa.

Since its introduction in 1996, cotton has been one of the lead crops to be genetically engineered and biotech cotton has been one of the most rapidly adopted technologies ever. The current varieties of commercial importance address crop management or agronomic traits that assist with pest management (Bt) (Bacillus thurengensis) or herbicide tolerance (HT). Nine countries representing 59% of world cotton area allow biotech cotton to be grown: Argentina, Australia, China (Mainland), Colombia, India, Indonesia, Mexico, South Africa, and United States.

Varieties with multiple traits (Bt and herbicide tolerance) are now available. The first varieties with two independently acting Bt genes (pyramided or stacked genes) were introduced in the US and Australia in 2003. These two-gene Bt varieties provide better efficacy and much greater resilience against the risk of resistance evolution.

Independent assessments indicate that millions of farmers in China, South Africa and India have derived substantial economic, environmental, health and social benefits from biotech cotton. That such benefits can be realized elsewhere seems highly likely, but the decision
to grow biotech cotton requires an initial careful analysis of the local need for biotech solutions, followed by deployment strategies that ensure farmers have the information and educational support to maximize their benefits from the technology

**Traits Available in Biotech Cottons**

While insect resistance and herbicide tolerance are the only traits currently available in biotech cottons, a broad range of other traits are under development using modern biotechnology. These may impact agronomic performance, stress tolerance, fiber quality and yield potential directly.

Apart from insect resistance and herbicide tolerance, biotechnology is being applied to issues of disease and nematode resistance or tolerance to various environmental stresses (heat, cold, and drought), all of which could improve realized yield. Biotechnology is providing a means for modifying the lipid profile of cottonseed oil to improve it nutritionally (e.g., high-oleic) and provide the functional properties for various food and industrial applications and to remove gossypol from cottonseed to enhance the feed value of meal.

Finally biotechnology is being used to modify cotton fiber quality by targeting specific traits such as fiber length, micronaire, color, and strength. While numerous possibilities can be imagined, and despite some advances in this area, the biology of cotton fibers imposes a strict reality. Because the cotton fiber is a single cell, it has been difficult to obtain accumulation of high levels of functional substances in the fiber. Also, cotton’s crystalline cellulose structure most likely affects many quality parameters that give cotton its desirable traits as a textile fiber, so disruption of the structure could complicate its quality.

**Risk Assessment For Biotech**

As with any new technology biotech cotton brings both potential benefits and risks. We can never know everything about a technology, nor definitively predict long-term consequences. Defining an appropriate, science-based, risk assessment framework that addresses realistic and assessable risks to human health and the environment and balancing these against potential benefits is the key requirement for the adoption of biotech cotton.

Many of the concerns raised about biotechnology relate to ethical issues, which question the right of man to tamper with the genetic makeup of other organisms, the right of companies to patent genes or various forms of life, or the potential dominance of multinational companies over small, developing economies. We argue that these issues are not resolvable through recourse to science, hence we do not address them further.

**Possible ecological risks**

Possible ecological risks requiring pre-adoption assessment are:
• Potential for gene flow and consequences on biodiversity and weediness
• Impacts on non-target species
• Resistance risk and its management

The potential for gene flow through pollen movement is an insignificant risk in the case of related species that are genetically incompatible with cultivated cotton (non-Gossypium Malvaceae and diploid Gossypium species). Where cultivated biotech varieties could co-occur with sexually compatible species (conventional varieties, wild or feral tetraploid species), the potential for pollen transfer is rare event, and specific measures could be implemented to further minimize the possibility of gene flow. Cultivated (and wild) cotton genotypes lack weedy characteristics.

Cotton is a self-pollinating plant, with heavy sticky pollen that is not wind dispersed. Natural outcrossing can only be mediated by certain insects. For gene flow to occur via normal sexual transmission, certain conditions must exist: the two parents must be geographically associated, their flowering periods must coincide, a suitable pollen vector must be present and active since cotton pollen is not wind dispersed, and the resulting progeny must be fertile and ecologically fit for the local environment. All the essential conditions are rarely present at the same time, so gene flow from cultivated cotton, whether biotech or not, to uncultivated genotypes is a rare event.

Non target species such as beneficial insects are not effected by the presence of Bt in the cotton and of course are more effective in controlling other pests. It is well known that most pesticides applied are just as fatal to beneficial insects as they are to the Bt target pests.

The evolution of resistance in the target insect pest or weed complex is the major challenge to the sustainable use of biotech cottons. For both herbicide tolerant cottons and Bt cotton some level of pre-emptive resistance management will be required, although the details will vary with local situation. Resistance management strategies will require a sound ecological understanding of the farming system and pest complex to allow the development of a pragmatic, yet scientifically valid strategy which can be implemented locally.

Strategies for the pre-emptive management of Bt cotton have been exhaustively explored with population genetic models and innovative methods to modify the selection environment imposed by Bt cotton on the pest. Resistance is not an inevitable consequence of the use of Bt cottons, but susceptibility to Bt proteins should be viewed as a valuable natural resource to be managed as carefully as the soil and water upon which cotton production depend directly.

*Magic Bullet or Valuable Component*
Biotech cotton varieties should not be perceived as “magic bullets” for pest control in cotton, but be recognized as a valuable component of integrated pest management (IPM) systems which can reduce the impact of key pests and address significant environmental concerns.

In seeking to establish policy on the introduction of biotech cotton varieties, all governments should take account of the potential for integrated pest management (IPM) and integrated weed management (IWM) systems to reduce insecticide and herbicide reliance and assess the need for biotech cotton as a component of such systems, not as an alternative. While Bt cottons clearly provide an opportunity to address significant environmental concerns about cotton production, their real value is as a foundation to build IPM systems which incorporate a broad range of biological and cultural tactics.

**The Real Benefits**

Farmer’s benefits accrue through reductions in pesticide use, equal or higher yields, no impact on fiber quality and increased income, while clear environmental benefits are delivered through reduced pesticide input.

Published literature from all countries growing biotech cottons indicates significant economic, environmental and social benefits. Biotech cottons, compared to their conventional counterparts, consistently have lower pesticide use and higher average profit in both large-scale and small-holder systems. Yields are usually higher and fiber quality is not affected. Indirect significant benefits of the technology include improved populations of beneficial insects and wildlife in cotton fields, reduced pesticides runoff, and improved farm worker and neighbor safety as well as soil-related environmental improvements through changed tillage practices with HT varieties. Perhaps most importantly the growing body of socio-economic analyses supports the view that Bt cotton at least can bring increased income levels to resource-poor farmers with significant flow-on gains for communities.

**Human Health Benefits**

Perhaps the most striking documented impacts to flow from biotech cotton is the human health benefits now widely identified in China and South Africa. These benefits flow directly from the reduced pesticide use required in Bt cotton varieties. Similar and perhaps larger benefits could be expected in other developing countries where resource-poor small-holders are required to apply pesticides by hand using minimal or no protection and poor equipment. Moreover the improvements in cash flow and reductions in time demand for manual spraying of crops opens up considerable opportunities for flow-on community benefits.

However, concerns remain about the influence of multinational companies with regard to the deployment of biotech crops in developing countries. As we stress in our conclusions, all countries should be free
to make their own decisions about adoption of biotech cotton or other products of modern biotechnology unconstrained by philosophical, ideological or economic pressures from outside.

It is imperative that small-holders are provided with options to adopt Bt or HT traits alone or in combination as the needs of their local situation demand, and with the educational support required to maximize value and environmental benefits.

Sustained access to biotech cotton varieties requires a combination of political will and commitment to provide the components of:

- a rigorous, transparent and effective regulatory process;
- a professional seed supply industry;
- farmer education and support structures;
- Intellectual property rights and a conducive business environment.

The most significant requirement for biotech crops is that they must satisfy a clear agronomic, environmental or social need and can bring demonstrable benefit to local farmers. So the trait(s) must be tailored to local needs, not imposed from other systems. Potential benefits from biotech traits can only be realized when they are expressed in well adapted and thoroughly tested varieties suitable for a given region. Full recognition and value should be placed on locally developed and adapted germplasm during any implementation of biotech cottons. The ongoing importance of conventional breeding efforts through public or private institutions should not be lost in an era of biotechnological advances.

Section 3—Crop Production is Basic—FAO (4,7,81)

The Food Problem

The demand for food in developing countries is enormous. The global demand for cereal grains over a 25-year period shows that the industrialized countries account for roughly 15% of this demand while developing countries account for 85%. (Sirageldin. 144). The same is true for meat products. When it comes to roots and tubers, the demand in the most industrialized countries will account for less than 3% of production while 85 to 95% will be used in the developing countries. And as new, urban lifestyles lead greater numbers of people to consume more fats and less fiber, more fast food and fewer home-cooked meals, developing countries face a double challenge – widespread hunger on the one hand and rapid increases in obesity, diabetes, cardiovascular diseases and other diet-related diseases on the other.

While this points to the ongoing importance of international trade in food, it also points to the need for a transformation in the efficiency of
agriculture in developing countries if these food requirements are to be met. It is argued that increasing yields, and not increasing the cultivated areas, is the only viable option to meet the increasing demand for food at less dollar expense and less damage to and better protection of biodiversity and endangered ecosystems.

Sirageldin (2004) reported that three options are available today to increase yields:

- high input agriculture,
- organic/peasant farming, and
- sustainable precision farming that combines the best science with best management practices.

High input agriculture is what we know in industrialized countries. Largely a phenomenon of the past 50 years or so, it relies heavily on chemical and energy inputs. It is often associated with large, highly capitalized production units. It is not a model easily applied to the smallholder farms of developing countries. The increasing reliance on chemical inputs has led many in the industrialized world to promote organic farming as a substitute. Perhaps the long-term solution will be precision farming coupled with the best of science for the needs of the poor. Sustainable precision farming is the promise; adapting and applying the best of science to small holder farms will be required if we are to meet present and future food needs of the least developed countries. The question of whether it is possible to combine the best science and the best management for crop production by the smallholder farmer is gaining stronger support with time. In developing countries, the problems are compounded by poor infrastructure for transporting food to urban centers. Long distances, bad roads, and urban crowding cause spoilage of 10 to 30 percent of produce in transit.

Clearly the value of a certain crop no longer depends on the suitability of the climate, but it depends on several other factors including, and most important, the human capacity to produce and deal 'with the crop in the fields and after harvest. The production of high value crops by the small farmer in the WANA (Western Asia and Northern Africa) region seems to be an option that could form the background and the potentials of increasing the income of small production units to help eliminate poverty and improve human livelihood.

In all the efforts aiming at environmental development, poverty elevation, and establishing food security strategies especially in developing countries, small holders are key players. Agricultural
activities utilize natural resources such as soil and water more than any other activity. As agriculture is considered to be the main tool to supply food for humans, an increased pressure on the natural resources have been observed. With an increasing population in cultivated areas, the per capita land share decreases. Small holders are becoming more numerous in developing countries, reaching thresholds under profitability levels.

The major management and developmental problems related to small holders are soil erosion, water use efficiency and water withdrawals that deplete the aquifers in a non reversible and unsustainable manner. Such a situation affects not only the existing population, but also reduces the natural resources availability for future generations. The end result is a consistent trend that the poor are getting poorer.

The Role of Horticulture

Horticulture is unique in that it can directly address poverty and food security issues in both urban and rural areas of the developing world. Gender represents another field for inequity and inequality since in much of the developing world it is women who carry the burden for both agriculture and nurturing the family. It is important to recognize the failures of policymakers and to promote greater investment in education and health and in rural infrastructure that benefits rural communities. The production systems in WANA region should be modified to achieve sustainability and to increase the income of the local farmers to sustain a decent standard of living. Achieving food security in the developing world will require the transformation of these economies and a doubling of the trade exports from the North to the South. This means reaching small holder farmers in the developing world and transforming their agricultural production. In many cases this means dealing with very difficult, low potential environments where it is not easy to see how such transformations can be accomplished. Beside the direct impact of the lack of food security that is expressed in the thousands of lives lost every day, there is a less obvious and even worse effect of hunger, which is malnutrition and element deficiency such as iron, iodide, and vitamins in food that result in reducing the production ability and mental power capability.

Horticulture is a vehicle to intensify land productivity and hence obtain more crops. Due to the fact that the market price of horticultural commodities is relatively higher compared with other crops, the income generated from the unite area of lands is also higher. The land ownership and the share of agricultural lands per capita are lower in WANA than in most of the countries with transition economy compared to the developed countries. Such a situation results in limited source of income families, and together with the high population intensity, poverty prevails. The dependence on low- cash generating commodities for agriculture cannot
generate enough income for rural inhabitants. Horticultural crops can be a salvation for such a situation. Another point here is related to the dependence on cereals as the main, and probably the sole constituent of diet. Malnutrition is expected due to the lack of vitamins and other food supplements. Horticultural crops provide the necessary supplements to assure a balanced diet for a healthy population. Horticulture also offers potentials for small value-adding activities that could help in generating income for rural areas and create opportunities.

**Horticultural as a tool to maximize land and water resource use efficiency:**

Horticultural crop production systems can also improve productivity and water use efficiency. Once water is collected or harvested, there is no point in using it for supplementary irrigation for a lower value crops. It is advised to utilize the water in the most intensive cultivation systems using high value crops to produce enough cash to sustain good living. In the case of arid environments, the best utilization of soil and water resources is a must. Information related to on farm water use is available in a wide range of publications. It is quite difficult to sum it in few lines. Nevertheless, it is important to stress upon the different patterns of agricultural activities and their relative differences in water use efficiency.

Irrigation systems vary in their water use efficiency. The amount of water required for an irrigation may be approximated by sampling the soil at several places in the field and estimating the moisture deficit. The water application is then calculated on this basis allowing for the possible losses. The irrigation efficiency for sprinkler irrigation could vary from 60 to 70%, improving to about 80% for localized irrigation, ranging between 45 and 75% in basin irrigation, and between 40 to 65 in furrow irrigation. The fact is that most of the horticultural crops in Egypt are now either grown in new lands where modern irrigation systems are used, or that the growers are turning to such systems to control salinity and water logging problems in old lands.

**Protected cultivations:**

The use of greenhouse and plastic house techniques had contributed substantially for the improvement of water use efficiency. The plastic or glass cover creates a special microclimate (Abou Hadid and El Beltagy, 1991) in which radiation and wind movement are lower than in the open field, while relative humidity is higher than in the open field. These factors favor a reduction in evapotranspiration (Eissa et al 1991). On the other hand, the higher temperature results in increased plant growth rate and results in more yield per unit area of the cultivated lands. The
increase in yield and reduction in water consumption under protected cultivation was reported by Abou Hadid et al (1992). The end result of this situation is larger yields under protected cultivation using less amounts of water which improve the water use efficiency as reported by Abou Hadid and El Beltagy (1992). The efficient use of water in greenhouses is also reflected on the efficient use of fertilizers. Many reports on this subject (Ismail et al, 1996; El Behairy et al, 1996; Abd Elmoniem et al, 1996) indicated that protected cultivation and soil less culture techniques help improve nutritional conditions in plastic houses and solve nutritional problems that could not easily be solved under open field conditions.

**Soil less culture:**

A remarkable example of the efficient use of water resources is the use of substrates in soil less culture for better vegetable quality and as a means for improving the water use efficiency. To clarify the relation between substrate culture and water use efficiency, it may be noticed that the field grown tomato produce 3 kg of tomato fruits per cubic meter of water, in plastic houses soil grown tomato produce 17 kg per cubic meter of water. Tomatos grown in substrate under plastic house conditions in Egypt produced 45 kg of tomato fruits per cubic meter of water.

Soil less culture techniques were developed under glass houses in order to overcome major agricultural problems such as nutrition, plant diseases and environmental pollution. It was found later on to be one of the most efficient tools for water saving. The development of a simple low cost system for hydroponics was the main challenge to make soil less culture possible. Several attempts to design and implement the different techniques of soil less culture were followed and were proved to be economically viable and environmentally safe. The utilization of such techniques resulted in improving water use efficiency to a great extent and helped to reduce the amount of chemicals used for both nutrition and for pest and disease control. The cost of production is relatively high but future research may be promising to reduce the cost and hence improve the applicability of these systems on a large scale in arid lands.

Limited water resources and rapid increase in population were the major factors that drew attention towards the use of intensive agriculture in Egypt. Protected cultivation was the first step, which started initially in the late seventies and intensified in the mid eighties. Maximizing crop yield per square meter of soil as well as per cubic meter of water could be achieved through the use of hydroponics systems. (Zayed et al. 1989).

Several possibilities and options of soil less culture are available in Egypt. Nutrient film technique (NFT) and rock wool are the most
developed systems. Even though it was found that rock wool should be replaced every other year, which means another additional cost compared to the nutrient film technique (NFT).

Several efforts have been made to introduce the nutrient film technique (NFT) in Egypt which started initially in the tourist villages where the soil could not be cultivated successfully. Never the less, there is still be a good opportunity to increase water use efficiency by using other systems like the aeroponic systems (El Shinawy et al, 1996).

_Global Horticultural Assessment vs Horticulture Research InstitutePriorities_

In the most recent publication of the Global Horticultural Assessment (GHA) as reported by USAID (2005), the major research priorities that were recommended in the publication on the global scale were related to market systems, post harvest systems and food safety, genetic resource conservation and development, sustainable production systems and natural resources management, capacity building enabling environment, gender equity, and nutrition and human health. The priorities of the Horticulture Research Institute (HRI) are listed next to compare with the GHA recommendations. The GHA list was deficient in at least one item – extension and education. The Institute was deficient in activities related to market systems, gender equity and nutrition and health.

**Global Horticultural Assessment Priorities**

*Market systems*
- Increase access to market information
- Strengthen producer and marketing organizations
- Impact of changing market systems
- Investment in marketing infrastructure

*Post harvest systems and food safety*
- Develop and disseminate appropriate post harvest technologies for small medium and large producers
- Enhancement of value-added processing techniques and opportunities
- Development and extension of food safety protocols and quality standards for horticultural commodities
Genetic resource conservation and development

- Development of high quality seed and planting stock programs
- Exploration, collection, conservation and utilization of indigenous genetic germplasm and knowledge systems

Sustainable production systems and natural resources management

- Development of integrated crop management strategies to address horticultural production demands
- Access to appropriate inputs and resources

Capacity building

- Information management and knowledge sharing systems for the horticulture value chain
- Strengthening human capacity through the development of effective extension and education networks
- Rebuild local scientific and technological capacity through innovative degree and non-degree programs
- Strengthen local research capacity with a focus on participatory methodologies

Enabling environment

- Critical evaluation of macroeconomic policies (tariffs, subsidies, trade agreements) that affect the horticultural industry
- Institution of effective intellectual property rights frameworks to protect national rights to genetics resources
- Regulatory mechanisms for protecting natural resources, worker and consumer safety and rights of small producers

Gender Equity

- Actively recruit female farmers, scientists and engineers for participatory research
- Research on gendered dimensions of horticultural production across and within regions
**Nutrition and Human Health**

- Evaluation of select horticultural crops for their nutritional properties and bioavailability
- Development of appropriate food-based solutions to alleviate micronutrient deficiencies and other health concerns

**Horticulture Research Institute Priorities**

*Genetic resource conservation and development*

1- Selection of new improved horticultural varieties of higher yield and superior quality.
2- Evaluation and testing of new varieties of vegetable crops and medicinal plants under Egyptian conditions.
3- Germplasm preservation through:
   - Establishment of mother farms of local fruit trees’ strains.
   - Mass propagation of superior strains and production of virus-free seedlings.
   - Introducing biotechnology methods and training of qualified scientists.
   - Identifying fingerprints of horticultural crops.
   - Using tissue culture technique for the propagation of non-traditional fruit crops.
4- Production of high yield and quality seeds of vegetable crops to meet the demand of seed companies.
5- Introducing new varieties and germplasm of some horticultural crops.

*Sustainable production systems and natural resources management*

6- Periodic visits to different locations of horticultural crop farms to identify the constrains to production to overcome them.

*Postharvest systems and food safety*

7- Conducting researches for studying different factors pre and after harvest factors that affect fruit quality to minimize losses and improve the quality.
Capacity building enabling environment
8- Expanding cultivation and production of high quality woody trees.
9- Developing of different herbarium groups for the Egyptian flora.
10- Survey and evaluation of the distribution and density of the Egyptian flora.

Extension and education
11- Organization of extension workshops and training programs for agriculturists, extensionists and growers.
12- Extension publications for horticultural crops.
13- Coordinating the ties between the scientific research results and the grower, through the dissemination of researches’ findings.
14- Periodic (weekly) scientific seminars in different aspects to discuss the new and modern techniques for the production of horticulture crops through the sharing of different specialist scientists from different universities and research centers.
15- Participation in local and international scientific meetings.

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**Section 4—Animal Agriculture (138, 145)**

*History of Animal Development in Agriculture*

Agriculture started in the Golden Triangle of the Eastern Mediterranean Area where crops were first cultivated. Of the 4,800-mammalian species that exist on the planet today, about a dozen became easily domesticated. Cattle originated around ten to twelve thousand years ago by domestication of the now extinct species Auroch (Diamond, 1997). There were several separate domestinations of cattle. One of which went to form the hump cattle found in the Indies, and the other the Bos taurus. Cattle were originally identified by Carolus Linnaeus as three separate species. These were Bos taurus, the European cattle, including similar types from Africa and Asia; Bos indicus, the zebu; and the extinct Bos primigenius, the aurochs.

Genes from both sub-species have contributed to the breeds that we know today. However, selective breeding of cattle to produce the milk and beef breeds that we recognize today only started about 200 years ago. Livestock breeding has progressed very rapidly since then, particularly during the latter part of the Twentieth Century. Animal agriculture is an often forgotten part of world agriculture, despite its scope and significance. Productivity gains will continue to be necessary as global demand for animal protein outpaces productive capacity. Today, livestock production accounts for 30 to 40% of world agriculture
production, and the demand for animal protein is increasing. Major productivity gains have been made in United States (US) animal agriculture over the past century. Productivity gains will continue to be necessary as global demand for animal protein outpaces world productive capacity. Genetic technologies, with proper oversight and risk assessment, can provide great benefits for years to come.

Animal agriculture in the developed world has become increasingly science and knowledge based and where this model has been applied there has been enormous success. To deal with the increasing consumer demand for animal protein across the globe, improvements in productivity will not be sufficient. An honest approach to trade issues will also have to be adopted, although such a resolution appears to be less than straightforward. For instance, growth-promoting hormones have become the basis of a serious European Union (EU)-US trade dispute on the basis of alleged safety concerns. Growth promoting hormones for the most part are natural steroids, which provide an increase in growth and a reduction in fat during the finishing stage of cattle production. More than 60% of the beef cattle in the US receive anabolic hormones and more than 90% of the cattle fed in feedlots are implanted with this hormone. A small plastic implant is inserted through a gun into the middle section of the ear. The amount absorbed on a time-release basis provides only slightly higher serum concentrations than might circulate normally in adult cattle. Since these implants are located in the ear, they are easily removed at slaughter, and residual hormone does not enter the food chain. Just about all scientifically reputable toxicological tests for residues in carcasses and food performed on both sides of the Atlantic, have indicated no danger to human health. By contrast the amount of "natural" hormone in foods, such as milk or peas and other vegetables, dwarfs those found in meat from the treated cattle. One would also have to eat hundreds of pounds of beef to consume the equivalent amount of hormone present in a single birth control pill. Yet these naturally occurring steroids have been banned in Europe.

Environmental, economic and social concerns

The loss of biological diversity is a major concern. 50% of the global production of eggs and 67% of chicken meat is industrialized. With only two companies providing layer hen genetics and four providing those for broilers, substantial shares of the world’s egg and broiler production depend on a small number of breeding lines which are designed to meet the needs of the industrial production.
Globally, 2/3 of milk is produced by high-output breeds. Dairy cattle breeding is focused on very clear but very few objectives: Milk amount and fat content, weight gain, feed efficiency, all under optimum production conditions. “Consistent selection for these traits has led to a genetic narrowing to an extent that, despite the fact there are more than 3.7 million Holstein cows enrolled in milk recording in the USA, the effective population size of the Holstein breed in the USA for 2004 was only 60 animals. Jerseys and Brown Swiss in the USA have 2004 estimates of effective population size of 31 and 32 animals, respectively.”45 Worldwide only a few thousand bulls are annually tested, and far less included in the reproduction of the millions of heads of industrial dairy and meat cattle. Increasingly, selected mothers of bulls are kept in the companies’ nucleus herds, thereby further reducing diversity. Embryo transfer and cloning technologies are expected to exacerbate the genetic monoculture. While industrial production with the same few breeds is spreading all over the world, local breeds are becoming extinct. Some 8000 breeds have been reported to the United Nations Food and Agriculture Organization (FAO), by most of its 190 member governments. More than 100 breeds were reported extinct during the past century. The loss is fast accelerating: 60 breeds were reported extinct during the past five years – a rate of one per month. FAO considers the spread of industrial production (from North to South) as one of the main reasons for the worldwide loss of breeds.

**Dairy Production**

Remarkable production gains have also occurred in the dairy industry in the United States. There has been a three-fold increase in production of milk per cow over the last 55 years. These data do not include the gains that have occurred from using bovine growth hormone (recombinant bovine somatotropin (rBST) or Posilac®). The genetics of the animal—the American Holstein—are primarily responsible for these productivity gains. The number of cows has decreased by almost two-thirds, and although large Holsteins individually consume more food and deposit more manure than before, on aggregate, less feed is consumed and less manure produced than 50 years ago.

How were such gains achieved? The precursors of the modern milk breeds were gradually derived from farmed cattle that were selected according to their milk production. Improved nutrition and artificial insemination, which began on a large scale only in the 1950s, had an enormous impact on productivity. Other reproductive technologies, such as synchronization of animals for estrus breeding and bull progeny testing, have also made positive contributions. More recently, bovine somatotropin (BST) has given startling gains. As genome projects advance, new information will be used to select animals for desirable
traits. With animal cloning techniques there is the possibility of maintaining desirable phenotypes (genotypes) indefinitely.

Production of Other Animal Industries

The gains in pork production are equally as impressive. Selection of lean animals has been emphasized over the last 20 years, although characteristics that producers favor have sometimes been preferred at the expense of consumers. Uniform animals can be more efficiently processed to give a predictable end product.

Other animal industries (e.g., beef cattle) have not been the beneficiaries of similar structured improvements in genetics and management and, hence, have not experienced similar gains in productivity.

An interesting case can be drawn from the US Thoroughbred Industry. The Kentucky Derby is the premiere horse race in the United States. In race times by the year there has been no statistically significant trend towards faster race times over the last 55 years. This result is interesting because it implies one of two explanations. Either there is a very narrow gene base upon which to draw or the thoroughbred industry has relied on arcane methods to improve the quality of the stock. Whatever the reason, it seems unlikely that Secretariat’s winning time in 1976 will be beaten any time soon.

Broiler Production

The first known US broiler production facility was founded in the 1920s. The industry has greatly developed since then and, particularly, over the last four decades. It is also now concentrated in just a few states. Table 1 shows the gains in broiler production over time. Broiler weight has increased, market age has decreased, and feed conversion rates have dramatically improved. Almost 50% of feed is now converted to meat. Mortality rates have dropped considerably, in part due to the relatively effective control over Marek's disease, which is caused by a virulent virus. A combination of better veterinary care, nutrition, and, particularly, genetics has led to this remarkable improvement. Even though the basis for genetic improvements has not always been well understood, selection and breeding have been remarkably successful. During the last 50 years, broiler production has improved as measured by the gain in live weight from 3.2 pounds in 1950 to 5.1 pounds in 2000; the market age has dropped from 11 weeks to 7 weeks and the percent morality has dropped from 8% to 5%.

Technology based Breeding for Genetic Improvement
Genetic improvement of the animal industry was known to be important long before we knew the details of the genome and even longer before we knew how to manipulate the genetics of the animal to achieve the desired quality and quantity of the desired product. Hybrid chicken were first developed in the 1940s by Henry A. Wallace, who was the 33rd Vice President of the United States (1941–45). Henry Wallace applied the same breeding methods to poultry that he had used to develop Pioneer Hi-bred corn. When two different lines are crossbred, productivity of the offspring increases considerably. However, this effect gets lost in the next generation, so that farmers in industrial production will buy breeding material for each generation. Within 10 years, all commercial poultry breeders bred poultry hybrids. Since then, hybridization has become common in pig and in aquaculture, and is currently being developed in cattle.

**Genetic engineering and cloning**

Genetic engineering has been feasible in poultry since the 1980s, and production of transgenic birds is common in laboratory chicken, and those used for pharmaceutical production in eggs.

Avigenics has been producing genetically altered chickens for the last four years, using a process called Windowing Technology, which introduces genetic material into eggs through a hole or 'window' in their shells. … The Windowing Technology enables the rapid and efficient production of transgenic chickens." The company had received a $2 million grant from the United States Department of Commerce for the development of the world's first cloned bird.

Transgenic salmon are also available. It takes half the time for the transgenic salmon to grow to market size. With high growth opportunities, especially in the North—where the meat, dairy and egg markets are saturated—, a concentration process is expected in aquaculture. The number of aquaculture species that can be farmed is rapidly increasing. Salmon, trout, sea bass, sea bream, and turbot, as well as other aquatic species such as shrimp and oysters are being adapted to industrial production with conventional breeding by selection as well as biotechnology. Hybrid salmon and striped bass are established businesses. A two line approach similar to hybridization is recommended as biological mechanism for property protection of shrimp breeding stock. “Pirated” shrimps will have a very low reproduction rate or even die if grown under less favorable conditions. Genetic sterilization of breeding stock is another biological control strategy in discussion.
Cloning is possible in sheep (1997), cattle (1998), pig (2000) and the horse (2006). Its efficiency is still low, and cloned animals may be born with, often fatal, disorders.31 However, cloning is expected to accelerate and intensify the activities of the animal genetics industry, especially with regards to delivering semen of top bulls and boars. In pigs, where artificial insemination does not, like in cattle, enable up to a million offspring, but only around 2000 offspring, cloning might be economically more promising.

European Commission’s Novel Foods Working Group decided on 17 January 2007 that in Europe cloned animals should be considered in the same way as any other novel food. Policy advisors, like members of the US-EC Task Force on Biotechnology Research consider the consumers attitude towards risk and benefit as key to acceptability of genetically modified or cloned animals. Low public acceptability so far is the main reason why major poultry and pig genetics companies claim not to produce GMO animals.

**Genome sequencing and marker assisted breeding**

By December 2004 the chicken genome was sequenced; the cattle genome followed in 2004/5. A map of the rainbow trout genome is being prepared at a US public research center. Sequencing the pig genome is also the main objective of a EU funded research program, “Sustainable Animal Breeding”, that started in April 2006. It is expected to be completely sequenced by 2007. 37 Shortly before, the US Department of Agriculture had approved 10 million USD for the same purpose. A Chinese-Danish group is also working on the issue.

After the chicken genome was sequenced, Aviagen started identifying genetic markers for naturally occurring traits. By screening pedigree lines, single base differences (or single nucleotide polymorphisms, SNPs), can be identified which will provide “an insight into what makes one chicken different from another”. The leading technology provider in human genomics will provide genotyping using a specially designed panel of over 6,000 SNPs for a large number of chicken DNA samples. The company is expecting “to build on the new breakthroughs in genomics research as it already has in place many of the foundation resources required, such as a good pedigree population structure, high quality performance data, a DNA bank of pedigree bird samples, and an excellent team of R&D specialists in molecular and quantitative genetics.

The Grimaud Group’s subsidiary Hubbard agreed with MetaMorphix to jointly develop genetic markers to predict desired broiler performance traits. Under the agreement, MetaMorphix will be entitled to receive a
royalty on revenues generated from the new breeds. "The use of GENIUS - Whole Genome System™ will allow Hubbard to …identify associations of predictive genetic markers with economically important traits, including health, welfare, meat quality, breeder and broiler traits. The use of genetic markers in on-farm progeny testing schemes as in cattle is likely to be led by breeding companies. Marker data is likely to be proprietary and confidential…Such data may well be made available under strict confidentiality arrangements and might not be published. Only the owners of the data will know which animals have been genotyped and what the individual animals’ genotypes are. Therefore, the published breeding values might be calculated using marker data but only data owners will be able to make best use of the information. The use of markers by dairy farmers is unlikely to be widespread until easy to use tools become more freely available and farmers more disposed to using them since the use of marker data at farm level is extremely complex.

Who Supplies the genetic material for animal breeding

As Scientists working in the field of animal genetics for improvement of the egg or meat production and quality, it is important to remember the major limitations and sources of genetic material. This fact provides opportunities to high quality stock, but it also provides limits and in some cases legal restrictions as to how the genetic material is made available and how it is used.

Only four companies supply the majority of genetics for commercial layer hens, broilers, turkeys and other poultry. The production of hybrid end-products and an associated structure, where multiplication and production are separated steps, allow for a de facto proprietary control over the breeding lines. This has strongly contributed to the extremely high concentration of the industry and the uniformity of genetic makeup. One of the world concerns is about genetic monoculture and the threat of endemic disease. Around two thirds of the world’s broiler and half of the world’s egg production is industrialized.

In cattle, although there is no hybrid breeding yet, and the animals are usually owned by farms less large than the poultry and pig factories, genetic monoculture has reached a similar level. A bull, with the help of artificial insemination, can have a million offspring. The dairy and meat producing communities cultivate their stars and pay high prices for a straw of frozen semen. Not surprisingly, the artificial insemination companies want to clone their best bulls. Cloning so far is not primarily meant for the dinner plates but to complement gene technologies.

Over past decades, breeding objectives focused almost exclusively on performance: yearly egg production, milk yields, milk fat content, and
growth rates. Efforts were concentrated on only a handful of breeds of cattle, pig and chicken. Substantial production increases were thus achieved – but only if the feed quality and quantity to make use of the better feed conversion rate is also provided.

With the onset of gene technology, companies who thus far focused on just one species, started to get interested in others. In 2005, the world’s largest pig and cattle breeding companies PIC and ABS were merged into one company, Genus plc, which also incorporates shrimps genetics. The size of livestock breeding companies as such are medium scale, with so far at most 2000 employees, and annual turnovers probably not exceeding 0.5 billion €, where information is available. However, they are usually integrated vertically with feed producing and/or meat processing companies, such as the US meat giant Tyson.

The US company Monsanto, better known for its leadership in genetically modified seed than in livestock genes, may soon dominate gene markets not only with regard to plants but also livestock, thanks to an aggressive policy of acquisition, cooperation and patent policy in cattle and pig genetics.

The rate of loss of the world’s livestock breeds has recently accelerated to one breed per month, while it was around one breed per year on average during the last century. The United Nations are currently raising the issue of the erosion of genetic resources, and the resulting threats for livelihoods and agricultural biodiversity. In Europe, where awareness about the roles and values of breeds has already reached the political level, conservation programs are being implemented. Thus, no more breeds have been lost in some of the European countries. However, what is being lost is food and cultural diversity, and food sovereignty.

**Poultry genetics industry: Layer hen, broiler and turkey**

Between 1989 and 2006, the number of companies supplying poultry genetics at a global scale was reduced from 10 to 2 in layers and from 11 to 4 in broilers. In turkey breeding, only three companies supply the world markets. Entrepreneurs all over the world wanting to produce eggs or poultry meat on a commercial scale buy genetic material – parent chicken for day-old chicks and hatching eggs – from this handful of globally operating producers. The Dutch company Hendrix provides the genetics for the layer hens of 80% of the world’s commercially produced brown eggs. White eggs are produced to almost 70% by layer hens originating from a German company, PHW.
Aviagen International Group Inc. (US/UK) is the global market leader in poultry breeding. It develops pedigree lines for the production of broiler chickens and turkeys, and sells parent stock as well as broiler hatching eggs, through own operations across Europe and the USA, and joint ventures in Europe, Latin America, South Africa and Asia.

The Grimaud Group is specialized in avian and rabbit breeding, and related gene technology for pharmaceutical and agro-industry. With the acquisition in 2005 of Hubbard Group, a major broiler breeder formerly with the pharmaceutical corporation Merial, the Grimaud Group doubled its turnover to reach 150 million € and became the second largest player in avian genetics and the leader in specialty segments (coloured chickens, ducklings, guinea fowls, rabbits, pigeons). Grimaud produces some 55 million day old ducklings, including some 1.5 million breeder day olds, 30 million chicken parent day olds (including over a million grandparents), 200,000 guinea fowl parent day olds and 30,000 breeding rabbits. In global multiplication, hatching and sales of commercial day-old ducklings, it holds a 40% market share. Hubbard held some 50% of each of the Russian and Syrian markets, 45% of the Egyptian and 70% of the Pakistani markets. Hubbard claim to be second in the European, Middle Eastern and African market with 25% of that area's parent stock market. When it comes to coloured bird production Hubbard's share is some two third's of the breeder market.

Cobb-Vantress is owned by Tyson Foods Inc., the world's largest processor and marketer of chicken and red meat. Tyson has 120,000 employees and a turnover of 26 billion USD. Tyson is the US market leader in poultry, and second in pork meat. Tyson powers America by producing nearly one out of every four pounds of chicken, beef, and pork Americans eat. Tyson is the only company selling all three proteins through all major distribution channels. The company leads domestic chicken production and domestic beef production with a 26 percent share in each market. Tyson holds the number two position in pork production with an 18 percent market share.

Only two internationally operating turkey breeding companies share the market, and both are integrated in breeding companies that have large international market shares of other genetic products. A third large turkey breeder is focused on the US market. Aviagen Turkeys was established in 2005 with the acquisition by Aviagen of British United Turkeys (B.U.T.) from the animal health company Merial. With Nicholas (US) and B.U.T., the European turkey genetics market leader, Aviagen has 350 employees and two turkey breeding brands, and delivers day old turkey poults around the world. Hybrid Turkeys, Canada, is part of Nutreco. Hybrid
ranks number two in the turkey genetics market, with a market share of
34%. Willmar Poultry Company (WPC) covers almost one third of the
US turkey breeding market, including integrated food marketing
companies and independent turkey growers. Some notable names
include: Sara Lee Foods, Cargill Turkey Production, Farbest Farms, and
various contract growers.

Cattle genetics industry
So far, cows for reproduction stayed with dairy farmers who bought high
performance bulls semen from Artificial Insemination companies. “The
world-wide market for dairy bull semen is increasingly controlled by
fewer companies. Even when chance alone leads to a farmer bred and
tested bull being of world class merit, the marketing of semen is usually
through a major company.

ABS Global, US, is the largest global bovine genetics company. Founded
in 1941, ABS became part of Genus plc in 2005. Genus’ turnover is
399.7 million €, and ABS contributes to 49% of it. The ABS Global
sales volume is around 10 million doses of semen, marketed in more than
70 countries. In comparison, all members of the US National Association
of Animal Breeders sell some 31 million doses of semen annually, to 92
countries, at a value of US $48,871,000. The US industry tests some
1,000 Holstein bulls, while ABS tests around 450 Holstein bulls
annually. The market power pays off with an increase average prices
of semen in 2005/2006 by 12% in the beef sector and by 10% in dairy.
The predicted farm concentration process in Europe is an important
target for ABS. The Chinese market, where public awareness programs
trigger an increasing dairy consumption, is probably the fastest growing
cattle semen market. Since 2006, ABS Global has an exclusive
representative in China through Alta Exports International.

<table>
<thead>
<tr>
<th>Species</th>
<th>1960</th>
<th>2006</th>
<th>% Δ</th>
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<td>Pig-kg lean meat /ton feed</td>
<td>85</td>
<td>170</td>
<td>100</td>
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<td>Broiler chicken; days to reach 2 kg</td>
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<td>Layer hen: Eggs per ton of feed</td>
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<td>Dairy Cows; Kg milk/cow/lactation</td>
<td>6000</td>
<td>10000</td>
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</tbody>
</table>

Table 1: Performance gains of livestock breeding in the USA 1960s to present

Source: Chris Warkup (Genesls Faraday), John Claxton (EC) and Ronnie Green
(USDA), 2006: Report of a Workshop on the Future of Livestock Genomics,
Aquaculture
In aquaculture, hybrid salmon and striped bass are established businesses. A two line approach similar to hybridization is recommended as biological mechanism for property protection of shrimp breeding stock. “Pirated” shrimps will have a very low reproduction rate or even die if grown under less favorable conditions. Genetic sterilization of breeding stock is another biological control strategy in discussion.

Genetic Selection Summary
Clearly, the gains from genetic selection and improvement are important and in a world with a rapidly expanding population, the benefits will be obvious and will tend to be dominant. It is equally clear that there are real concerns. One is genetic diversity. The corn disaster of the 1970’s is an example that should never be forgotten.

As Egypt looks for opportunities to expand its animal productivity and marketing opportunities in Europe, it will need to look at the pluses and minuses carefully, but wisely. The need for decisions based on scientific knowledge and social issues is further evidence that the quality of research in Egypt is one of the most important factors in the country’s future.

The material in this section taken from Genetic Resources of the United Nations Food and Agriculture Organisation, to be held 7 September 2007 in Interlaken, Switzerland

Summary of Animal research in Egypt
The following list represents the research priorities of the animal development and improvement effort in Egypt. The research will be carried out in the four institutes that support animal agriculture. A continuous review of animal development and concerns in the United States and WANA countries will provide the research leaders with one example to use in considering the appropriateness of the Egyptian priorities.
1- Increasing the productive and reproductive efficiency of Egyptian buffalo by pursuing an environmental and genetic improvement program and providing selected genetically superior buffalo bulls or their semen to private sector farmers, small holders and all organizations dealing with water buffalo breeding.
2- Improving the productivity of endogenous cattle by crossing with high productive exotic breeds using artificial insemination to produce crossbred strains adapted to small farmer conditions.
3- Introducing embryo transfer technology as a rapid tool for genetic improvement.
4- Increasing the twinning rate of local sheep by crossing with prolific temperate genotypes from exotic breeds.
5- Improving the productive performance of local goats and determining genetic measurements that can be used in selection of local breeds.
6- Producing local and developed strains of poultry and rabbits adapted to the local environmental conditions.
7- Expanding the utilization of agricultural by-products in animal feed to reduce feed cost and reduce environmental pollution.
8- Evaluating nutrient requirements, feedstuffs, and feed additives for livestock and poultry.
9- Evaluating the properties and quality of milk and dairy products.
10- Establishing a department of Biotechnology, which includes the activities of artificial insemination in small and large ruminants, embryo transfer, in-vitro fertilization, bovine blood typing and DNA sequencing.
11- The Institute has executed ambitious programs in 9 governorates to develop animal production using research packages of artificial insemination, good nutrition, optimizing milk yield and encouraging processing of dairy products through the Food Sector Development Program (FSDP). Also, through FSDP, the Institute has established 4 technical offices in its research stations to provide technical advice in all animal production disciplines.
12- Establishing a breeder service unit, which provides services of herd recording, feed and milk analyses and mastitis detection for the private sector projects and small farmers.
13- Establishing the elite herd of buffalo to produce genetically superior bulls and disseminating them among small breeders and scientific institutions to improve the genetic characteristics of buffalo.
14- The Institute has founded research station for camel research in Marsa Matrouh and poultry research station in El-Sabahia, Alexandria. An International Poultry Training Center is being established in the same station.

**Animal Health Research Institute**

The Animal Health Research Institute (AHRI) was originally established in 1904 as the Laboratory of Veterinary Pathology in Giza. Its main
responsibilities were the production of limited amounts of hemorrhagic septicemia and fowl cholera vaccines, in addition to examining pathological samples received from different districts. In 1950, it became the General Directorate of Veterinary Research Laboratories consisting of three major laboratories for research and diagnosis of animal and poultry diseases, animal reproduction, and serum and vaccine production.

With further development, it was necessary to augment the General Directorate of Veterinary Research Laboratories to meet the growing needs of private and governmental farms. The augmentation took place in 1983 when ARC was formulated. The three laboratories within the General Directorate of Veterinary Research Laboratories were separated and evolved into three ARC research institutes: Animal Health, Animal Reproduction, and Veterinary Serum and Vaccine Production.

The institute continually develops and promotes the quality of its applied research based on issues relating to the preservation of animal resources and the protection of man from animal-transmitted diseases. Basic and applied research is directed to the diagnosis of animal, poultry and fish endemic and exotic diseases.

**Animal Production Research Institute**

The Animal Production Research Institute (APRI) dates back to 1908 when an independent Animal Breeding Section was formed. Its responsibilities were limited to applied research and activities related to buffalo, cattle and equine breeding. Since 1921, it has been affiliated with the Ministry of Agriculture as a branch for animal breeding. In 1939, the branch was transformed into the Department of Animal and Poultry Breeding, and then into the Department of Animal Production in 1944. In 1952, it was converted into the General Department of Animal Production, and in 1971, when the ARC was formed, APRI became one of its research institutes.

By engaging in research and extension activities, APRI aims to accomplish a number of objectives, consisting mainly of increasing production, enhancing genetic traits, upgrading the quality of local, cross and exotic breeds of animals, poultry and rabbits, reducing the cost and improving the quality of dairy products and animal feeds and evaluating the properties and quality of milk and dairy products.

**Animal Reproduction Research Institute**

The Animal Reproduction Research Institute dates back to 1968 when the first center for bull investigation in Egypt was established. Its main responsibilities were the examination of bulls used for artificial
insemination or natural breeding purposes, in addition to examining samples received from districts throughout Egypt for diagnostic purposes. Earlier experimental methods brought artificial insemination closer to scientific application in 1935. In 1959, a veterinary training center was inaugurated, and in 1960, the first artificial insemination center in Egypt was established within the Ministry of Agriculture. A reproductive diseases laboratory diagnosis program was initiated in 1962 within a Food and Agriculture Organization (FAO) project for the evaluation of emerging exotic reproductive diseases. The bull investigation center that was formed in 1968 was upgraded, developing its structure and facilities in order to meet the growing demands for establishing private and governmental farms for scientific research concerning the reproductivity of animals. The center joined the General Authority for Agricultural Research (which later became the ARC) as part of the Animal Health Research Institute (AHRI) it became independent in 1983. When the ARC was formed under the name of the Animal Reproduction Research Institute (ARRI)

The goal of ARRI is to raise the reproductive efficiency of farm animals through organized scientific laboratory and field studies. Special consideration is directed towards investigating fertility problems, combating reproductive diseases, applying artificial insemination, conducting research on the freezability of semen, enhancing different aspects of the embryo transfer technique, investigating biology of reproduction issues, and developing programs for rearing calves and care of the udder.

**Veterinary Serum and Vaccine Research Institute**

The Veterinary Serum and Vaccine Research Institute, formerly called the Veterinary Serum Laboratory, is one of the oldest in the Middle East and Africa. It was established in 1903 and affiliated with the Ministry of Health until 1914 when it became part of the Veterinary Medicine Department within the Ministry of Agriculture. Earlier responsibilities were limited to producing virulent blood and antiserum, previously imported, for protecting cattle against Rinderpest (cattle plague). The laboratory's mission continued to grow.

In 1928, research continued to develop more sera and vaccines necessary for protecting animal resources. In 1934, Rinderpest vaccine was produced. The severe epizootic outbreak of African Horse Sickness in 1944 resulted in a large scale vaccine production program. The following period saw considerable laboratory expansion and new building construction. New vaccines such as Newcastle, Rinderpest tissue culture, Foot and Mouth disease, and Rift Valley Fever vaccines were produced in 1948, 1963, 1973, and 1978, respectively.
The Veterinary Serum Laboratory became an independent institute, affiliated with the ARC, in 1983 and renamed the Veterinary Serum and Vaccine Research Institute (VSVRI). The institute has gained international recognition and has been exporting vaccines to Arab, African, and Asian countries since 1980.

VSVRI carries out its role of protecting animals and poultry against contagious and infectious diseases through the production of various vaccines, specific antiserum, and diagnostic reagents. It conducts research associated with the development of bacterial and viral vaccines, diagnostic products, and antiserum to immunize farm animals, poultry, and pet animals against outbreaks of infectious diseases prevalent in Egypt or introduced through importation. The institute also produces abundant amounts of veterinary biological products for mass vaccination of the animal and poultry populations. VSVRI is also establishing a central quality control lab to evaluate veterinary biological products.

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Section 5--Genetic Engineering Research Institute

It is obvious from the discussions about Biotech Cotton and the exceptional gains in the productivity of food animals that the research carried out in the Genetic Engineering Research Institute is a key and critical part of the future of plant and animal research in Agriculture. Egypt is fortunate in having one of the best centers of GE research in the Mediterranean region. Much of the future growth and improvement of plant and animal food production will depend on the accomplishments of this Institute.

It is important to recognize that such research is not inexpensive and hence to be effective and productive, it will need the best financial and political support possible. Political support because there are so many organizations that delight in doubting the safety and efficacy of this scientific process. This is nothing new. Such attitudes have been present with most of the major scientific developments in the world. These questions must be heard and answered, but they must not be used to frighten and disadvantage the public without solid data.

The following research priorities are designed to meet the needed goals of Egyptian agriculture:

1- The isolation and cloning of Bacillus thuringiensis (Bt) endotoxin genes from Bt isolates collected from different Egyptian habitats that are effective against different orders of insects.
2- Transgenic potato lines expressing Bt toxin genes have been developed and evaluated for potato tuber moth (PTM) resistance.
3- Within the Bt research domain, a biocontrol agent AGERIN was formulated and commercialized through a private company. The product controls Lepidoptran insects infesting many crops.
4- Plant viruses infect economic horticultural crops in Egypt causing devastating losses. Therefore, AGERI targeted major commodities and applied genetic engineering technologies to successfully develop potato lines resistant to potato virus X (PVX), potato virus Y (PVY) and potato leaf roll virus (PLRV); melon and squash lines resistant to zucchini yellow mosaic virus (ZYMV) in addition to tomato lines resistant to the whitefly transmitted Geminivirus, tomato yellow leaf curl virus (TYLCV).
5- Molecular Markers, restriction fragment length polymorphisms (RFLPs), random amplified polymorphic DNA (RAPDs), amplified fragment length polymorphisms (AFLPs), and microsatellites or simple sequence repeats (SSRs) have been used to study genetic variability and
to fingerprint economically important crops such as cotton, maize, tomato, date palm and rapeseed.

The ongoing research projects undertaken at AGERI are focused on problems facing Egyptian agriculture. The immediate objectives are to utilize cellular and molecular biology methodologies to develop and deliver transgenic elite cultivars resistant to biotic and abiotic stresses and have the potential to cause a significant impact on crop productivity, the economy and the environment.

1- Resistance to Insects And Stress Tolerance in Egyptian Cotton: Millions of dollars are spent annually on the purchase of imported pesticides to combat insect pests in cotton growing areas. The production of Transgenic cotton plants (Gossypium barbadense L.) expressing insecticidal toxin gene (Bt) is one of the main targets of AGERI. Different Bt genes expressing toxicity against Lepidoptera, Coleoptera and Diptera insects have been isolated and cloned. Modification of specific Bt genes for maximum expression of the toxic protein in cotton plants is currently underway in addition to optimization of the regeneration and transformation system. Identification, mapping and cloning of genes encoding stress tolerance is another activity aiming at transferring these genes into superior genotypes to develop heat tolerant and salt tolerant cotton lines.

2- Disease Resistance in Tomato: Whitefly transmitted geminiviruses, specifically tomato yellow leaf curl virus (TYLCV), have been identified as the most devastating plant viruses infecting tomato in Egypt. Different gene construct strategies are being used in transforming tomato cultivars to produce transgenic tomato resistant to (TYLCV). Molecular diagnostic methods have been developed to detect geminiviruses infection in tomato.

3- Development Of Potato Varieties Resistant To Virus Diseases And Insects: Development of Transgenic potato lines resistant to different virus diseases predominant in Egypt is probably the most effective means in achieving sustainable potato production. The coat protein strategy has been adopted to produce resistance to potato virus Y and replicas gene for potato leaf roll virus (PLRV) the transgenic lines are in the field testing stage. Transgenic potato lines were developed with a Bt endotoxin gene (cry V or cry IAC) incorporated in the genome via Agrobacterium mediated transformation. Greenhouse and field evaluation of these lines was carried out under artificial and natural infestation with potato tuber moth (PTM). Highly resistant lines were selected for future commercialization.

4- Development Of Virus Resistance in Cucurbit Crops:
Plant viral diseases are usually very destructive and difficult to control. The yield and quality of Egyptian melon and squash are drastically by zucchini yellow mosaic virus (ZYMV). Therefore, one of the objectives at AGERI was to introduce resistance to ZYMV into the Egyptian top market cucurbit cultivars. The coat protein gene of ZYMV was introduced in the squash variety Escandarany and the melon variety Ananas El-Dokki. Field testing and selection of ZYMV resistant lines was carried out. All biocontainment greenhouse and field evaluations were submitted to the National Biosafety Committee (NBC) for approval.

5- Development of Resistance Stem Borers in Maize:
Maize field in Egypt are infested with three species of stem borers, of which Sesamia cretica is the most damaging.

The introduction of genetically modified maize plants with insect resistance (Bt toxin gene) will be of great value not only in maximizing yield, but also in reducing the use of hazardous chemical pesticides. Elite maize inbred lines have been screened for their regeneration capacity using two systems; immature embryo culture and multiple shoot meristems. Studies were carried out to increase regeneration efficiency in the selected lines with optimization of the transformation system using the biolistic gun. A cassette containing a novel Bt endotoxin gene isolated from an Egyptian Bt isolate is being constructed to transform these lines.

6- Genome Mapping Of Economically Important Crops:
This activity involves the development of comprehensive genetic maps for economically important crops such as maize, tomato, cotton, date palm and rapeseed. The importance of a genetic map is that it provides molecular markers linked to agronomically important traits which facilitate marker-assisted selection in crop improvement programs thereby decreasing the time required for the introgression of desirable genes into elite genetic backgrounds and also for map based cloning. DNA fingerprinting of elite germplasm is also conducted for practical plant breeding purposes, mainly cultivar identification, estimation of genetic relatedness, monitoring seed purity and plant propriety rights protection.

7- Development Of Transgenic Wheat With Improved Tolerance To Environmental Stresses:
Research at AGERI aims at cloning and introducing genes that confer tolerance to drought and salinity into wheat varieties. Currently,
transgenic lines are being evaluated in the bio containment greenhouse and in field trials under rain fed conditions.

Danforth Foundation support for AGERI

Only three percent of Egypt's land area can sustain productive farming. Due to the limited amount of arable land, Egyptian scientists continue to seek new and innovative ways to improve agriculture in their country. Ancient Egyptian farmers, like today's modern farmers, are known for employing agricultural techniques such as dense cultivation, irrigation, and the use of fertilizers to secure some of the highest crop yields in the world. In their continuing efforts to improve their agriculture, scientists at the Agricultural Genetic Engineering Research Institute (AGERI) in Cairo employ modern biotechnology to develop new ways to improve agricultural production.

AGERI is the primary institute responsible for managing agricultural genetic engineering research in Egypt. The Donald Danforth Plant Science Center and AGERI have recently initiated several research projects that employ biotechnology to improve Egyptian agriculture.

In Egypt, the *Tomato yellow leaf curl virus* causes about 65 percent yield losses in tomato annually. In a new research collaboration, Dr. Claude Fauquet (Danforth Center) and Dr. Naglaa Abdallah (AGERI) are investigating new ways to control the spread of the virus by developing tomato plants that will resist the spread of infection by whiteflies.

As recently as the 2003 and 2004 growing seasons, Egypt's potato crop was ravished by severe epidemics of Late Blight Disease. Potatoes are the second most important vegetable crop in Egypt in terms of crop value and total production. The Danforth Center's Dr. Karel Schubert has joined forces with AGERI's Dr. Taymour Nasr Ed-Din to produce a genetically modified potato that is resistant to blight disease. Late Blight Disease was responsible for the well-known Irish potato famine that killed over 1 million people in Ireland from 1845-1850. It has been estimated that blight resistant potatoes could save Egyptian farmers almost $1 million annually by reducing the use of pesticides and may increase potato production by more than 50 thousand tons.

In 2004, Egypt produced more than 16 million metric tons of sugarcane. Sugarcane Pokkah Boeng Disease is a severe disease caused by a fungal pathogen. Unfortunately for Egyptian farmers, chemical fungicides do not effectively control this disease. To assist these farmers, Danforth Center's Dr. Dilip Shah and AGERI's Dr. Naglaa Abdallah are working
to develop genetically-modified sugarcane with enhanced resistance to Pokkah Boeng Disease.

Recently, Mr. Lawrence Kent, director of the Danforth Center's International Programs, visited Egypt and provided Dr. Abdallah with materials from Dr. Shah's laboratory. "The three collaborative research projects between Danforth Center and AGERI scientists provide great promise to improve agriculture in Egypt," Mr. Kent said. "We hope that these new technologies will eventually benefit Egyptian farmers."

Since its establishment in 1989, Egypt's Agricultural Genetic Engineering Research Institute has received support from the United States Agency for International Development. A team recently visited Egypt with a team of experts from the University of Illinois - Urbana Champaign to develop a strategy to ensure AGERI's long-term sustainability.

Section 6-- Agriculture Economics Research Institute

The Agricultural Economics Research Institute (AERI) was established in 1943 as the Agricultural Economics Department. In 1949, it became the Agricultural Economics and Legislation Department and consisted of agricultural foreign relations, statistics, agricultural economics, and legislation divisions. In 1958, it became a research department for agricultural economics and statistics. With the increasing demand for the Ministry of Agriculture's services during the 1960s, the department was organized into eight divisions. When the ARC was established in 1971, AERI became one of its first institutes responsible, together with other institutes, to improve the technologies and services available to Egyptian agriculture through research and extension.

The main objective of AERI is to conduct research in the fields of agricultural economics and statistics for the purpose of developing production and income within the framework of the national agricultural policy. Specific goals include:

- Economic analysis of different Egyptian agricultural commodities.
- Improving statistical data collection and analysis, and establishing accurate agricultural databases
- Preparing the economic and statistical information needed by decision makers.

In addition to conducting economic and statistical studies in order to find solutions to several economic problems & issues, this institute focuses on the following:
- Highlighting the marketing methods of agricultural commodities that could maximize profits for agricultural produces, high quality of agricultural crop, and improving export of agricultural commodities.
- Studying the current financial and agricultural credit policies and suggesting how to improve it in context of the free market mechanism.
- Conducting rural community research studies to help improve standard of living for rural people.
- Studying economics of agricultural labor and mechanization.
- Studying the current situation and outlook of agricultural commodities and agricultural inputs.
- Developing and improving sample techniques in order to obtain reliable and timely agricultural statistical estimates.

*Conduct Economical and Statistical Studies Covering the following Topics*

- Study the effect of the World Trade Organization on the Egyptian agricultural sector.
- Outlook of cooperation between Egypt and Arab groups in the field of animal production.
- Investigation studies about the main agricultural exports and import commodities of COMESA with concentration on Egypt.

**Section 7-- Food Technology Research Institute Goals**

- Improving quality of food products to cope with the international measures needed for exportation.
- Improving processing procedures in the field of bread and bakery products, dairy products, fish and meat products as well as processed horticultural products.
- Continuing the evaluation and monitoring of food consumption pattern to cover the entire country.
- Finding new sources for food and reducing food losses and finding new methods to reduce environmental pollution.
- Recycling of farm, factory and slaughter-house wastes in food products either by raising its added value or in ensuring safe disposal.
Introducing simple and new applicable methods in food quality control.

Technologies transfer to users and strengthening the relationship between researchers and food processors.

Conducting feasibility studies for investors in food processing.

Conducting training and extension programs for small-scale food projects.

Encouraging overseas training programs specially those held in the developed countries about new trends in the field of specialization.

Focusing on training programs that aim to develop women in rural society.

Conclusions

Financial Support for Egyptian Research

For the past 30 plus years, the scientific and technical developments in Egypt has been supported by USAID, World Bank, IMF, FAO, ACDI/VOCA, Ford Foundation, Rockefeller Foundation, IFAD, GTZ, European Agencies, numerous foundations, the Egyptian Government and others I am sorry to have left off the list.

Recently the European Council has made a major commitment to help Egypt implement the European Neighborhood Policy which will have financial value as well as value in dealing with international legal matters.

Europe and Egypt to cooperate on science plan

[CAIRO] Egypt’s EU-Egypt Association Council has agreed to a series of scientific and technological reforms under a European Union (EU) initiative to foster deeper political and economic harmony with its neighbors.

The reforms were developed as part of the European Neighborhood Policy (ENP).
The European Commission has approved around US$733 million to help Egypt implement the ENP reforms from 2007–2010, although sources in Egypt told SciDevNet that the allocation for the science and technology reforms has not yet been decided.

Planned activities include development of a 'patent culture' in technology parks and universities, which will be organized by intellectual property offices, as well as the introduction of a doctoral level program in intellectual property law.

Egyptian scientists' access to European scientific databases and their participation in European research groups and international scientific debates and conferences will be improved.

In a bid to promote technology-based industry, the reforms call for better interaction mechanisms between research and industry, and the creation of regional 'technopoles' — towns with teaching and research facilities which can support the development of hi-tech industries.

In addition, scholarships will be offered for Egyptian students to attend European universities, broader links between EU and Egyptian scientific institutions will be established, contacts between academics will be improved and Egypt will be eligible for ENP funds to encourage cross-border co-operation and sustainable development.

Egypt will also increase its collaboration with the EU in common energy strategies, nuclear safety, information technology, education, agriculture and fisheries, and environmental issues, such cleaning up pollution in the Mediterranean.

The council established a new expert-level sub-committee to make sure that the reforms are implemented and take stock of progress made.

Hassan Moawad Abdel Al, former president of Alexandria's Mubarak City for Scientific Research and Technology Applications, told SciDev.Net that the reforms would not only build Egypt's scientific capacity, but also strengthen science capabilities in other Arab and African countries.

**Critical Emerging Issues**

We are told repeatedly that the crisis in the World food supply is not one of production but of distribution and that the solution is political. Nevertheless, even if structural solutions improve food distribution, world population will soar from 6 billion to 10 billion, or thereabouts, by 2050. This increase in population will necessitate a vast increase in the
amount of food produced. At the same time the area of useful agricultural land is shrinking and, in many cases, deteriorating in quality. As a result of this intensity of farming, natural resource management will have to be improved.

**Investment in Agricultural Research**

To maintain the historical gains in animal productivity, scientific knowledge through research must continue to advance. Relevant investment in agricultural research is needed in both Europe and in the United States to maintain food production and to achieve agricultural sustainability. Yet, it is unclear that such investments are possible within the existing political environment.

Before World War II, 40% of the US federal research dollars went into agriculture. The situation has changed markedly since then. The USDA's portion is now only 4%. Of this approximately $1.8 billion, only a small fraction, less than $150 million, is directed towards long-term, peer-reviewed, competitive research. The result is that most young researchers are increasingly focusing their attention away from agriculture and toward the health-related research activities. Yet it is possible to make a strong case that agriculture is contributing greatly to the health of the US and global population, and that research is vital if agriculture is to continue to meet food needs.

**Biotechnology**

Emerging technologies must also be nurtured and employed effectively. Genetically modified foods are currently at a stage where they could flounder or bring great benefit. Their existence is threatened as the result of perceived but, in many cases, unfounded safety considerations and the ensuing negative public response. Jarrod Diamond, in his book, Guns, Germs and Steel describes how the Japanese developed a sophisticated firearms industry in the sixteenth century, only to abandon it for 300 years because it conflicted with Samurai tradition. The development of technologies can be slowed down and even lost in an incompatible social context. Genetic technologies have a bright future in agriculture as well as in medicine. With proper oversight and risk assessment they can provide great benefit in the difficult times ahead.
PART FIVE

AGRICULTURE PROVIDES FOOD AND JOBS THROUGH RURAL AND URBAN DEVELOPMENT

Egyptian agriculture is now more responsive to domestic and international market forces, less constrained by government involvement in production and marketing decisions, and more open to competition than ever before. However, policy constraints continue to prevent Egypt from fully realizing the comparative advantage it has in most commodity systems. It is important to understand that GDP growth depends largely on the ability to expand production in the tradable sectors, while employment growth depends largely on increases in (domestic) demand for non-tradable products. Treating “rural” and “urban” poverty as somehow separate and in competition with each other for resources is not only a conceptual mistake, but a remarkably short-sighted view of the problem. In fact, successful rural development generally stimulates and supports urban development. Conversely, urban growth is a powerful stimulus to food production, especially by small farmers. Access to flourishing urban markets contributes both to the reduction of rural poverty and to urban food security.

Knowing that agricultural growth is not only important to growth in national income, but also absolutely vital to growth in employment and reduction of poverty, we use a statistical model to look at what can happen in Egypt under various conditions of management, policy change, commodity choice and use of technology. This “model exercise” is intended to determine feasible growth rates that will have a substantial effect in raising employment growth rates to meet the one million new jobs needed in Egypt each year.

CHAPTER 9

AGRICULTURE’S ROLE IN ECONOMICS AND EMPLOYMENT
Confidence in the convertibility of the Egyptian pound had improved sufficiently for the currency to begin to strengthen against the US dollar (and other major currencies) on the official foreign-exchange market by December 2004. The pound appreciated by some 7% between late December and early February and black-market activity is now minimal—although it does persist. The appreciation marked the first strengthening of the pound on the official market since its ten-year peg to the dollar was broken in early 2000. This was followed by an aggregate 45% decline, including a fall of 25% during 2003 alone following a mismanaged "float". The rise was facilitated by strengthening foreign-currency inflows and steps taken by the Central Bank governor to improve access to foreign currency and raise rates on Egyptian pound savings instruments. More broadly, improved confidence in economic policymaking under Mr Nazif’s government contributed to the pound’s rally.

Indeed, the situation improved to the extent that the authorities sought to prevent the pound appreciating too strongly by purchasing hard currency in the market. This is in part driven by an effort to support non-oil exports, but has also facilitated a substantial build-up of foreign reserves since the start of the year 2005, in turn bolstering the authorities’ ability to effectively manage the pound. Overall it was expected that the pound would rise to an average E£5.78:US$1 in 2005, from E£6.2:US$1 in 2004, and to E£5.73:US$1 in 2006 (July 2008 it is 5.3:$1). This will mark a cumulative real appreciation of about 14% against the euro and 13% against the yen, but the competitiveness of Egyptian exports will not be compromised significantly given the extent of the fall in the pound since the start of 2000.

**Economic Status of Agriculture in 2005**

“According to economist intelligence report, the share of agriculture in nominal GDP fell from percent 25.6% in fiscal year 1985-86 to 13.9% percent in fiscal year 2005. But the sector is still the country’s largest employer accounting for about 28% of the labor force, down from 34% in fiscal year 1991.

Egypt is a major producer of premium long and extra long staple cotton. Cotton is the country’s largest agricultural export and was for many years the most extensively subsidized commodity; however, the sector has suffered from inconsistent state policy, inflexible export pricing and a government more interested in propping up the massively overstaffed 1 million workers and debt ridden state owned spinning and weaving industries thru the provision of cheap cotton. Cotton production and exports have declined and the proportion of cultivated land planted to
cotton has consequently dropped sharply from 924,000 hectares in 1962 to 302,400 hectares in 2005.

Since 1986, controls have been removed from almost all crops. Controls still in place affect sugar cane produced by large state run factories in upper Egypt, rice cultivation which is restricted in some areas owing to water shortages, and specific varieties of cotton which have to be cultivated in designated areas.

By 1994 many subsidies for fertilizers, seeds and pesticides had been eliminated although energy continued to be provided at reduced rates. The result has been impressive gains in output with wheat and rice crops reaching record levels and self sufficiency has been achieved in several important commodities. Some 95% of local production is consumed domestically despite the increased emphasis on cash crops for export, notably horticultural produce. Nevertheless, population growth will insure that Egypt remains one of the world’s largest food importers. Food imports accounted for 11.6% of the total imports in fiscal 2004. Egypt is one of the world’s major wheat purchasers, buying about 6.5 million tons per year.

An estimated 3.5 million farmers cultivate holdings of an average size of two feddans or 0.84 hectares. Production is therefore intensive and yields are among the highest in the world despite the irregular and insufficient supply of water for irrigation. Only 3% of the total land area is arable of which about 1/3 is serviced by main and secondary drains, and many are in dire need of repair. Drainage has proved to be insufficient to counter water logging and high soil salinity which are the unforeseen consequence of a rise in the water table following the construction of the Aswan dam. In addition, only 2% of the 8 million feddans of cultivated land are irrigated by modern methods. Egypt’s cropped area is 14.5 million feddans.

In response to the pressures on arable land for production and for housing, some one million feddans of desert had been reclaimed by 1995 bringing the surface area of cultivable desert land to about 3 million feddans. Another 3.4 million feddans are to be secured by 2007. However, the area under cultivation has been more or less constant as agricultural land is lost to urban and industrial expansion at about 30,000 feddans per year.

Fertilizer use is among the highest use among developing countries at an annual 465 kilograms per feddan. Excessive regulation in the production of fertilizer has become a deterrent to the development of private and foreign investment. As a result, Egypt has a 20% shortfall in its own fertilizer needs. This heavy regulation has also made privatization of state owned fertilizer companies almost impossible.

Although livestock production is dominated by small farmers who account for about 80% of output the number of modern dairy and feed
farms has increased over the last few years. There are 3.9 million cattle and 3.7 million buffalo as well as 5.1 million head of sheep and 3.7 million goats. Cattle are mainly kept for dairy production but nevertheless, 80% of domestic red meat consumption is produced locally. The poultry industry in which the public sector has invested heavily is greatly affected by international supplies and prices since most of its components are imported and sharp fluctuations in production and prices have put many producers out of business. The nine year ban on poultry imports was lifted in July 1997 but import duty was set at 80% to protect the local industry.

According to national figures, the fish catch was 724,000 tones in 2001 about 35% of which was marine. Egypt exports some 2900 tones per year of fine quality fish. The government is aiming to increase annual production by encouraging the use of the country’s inland lakes and waterways for intensified aquaculture.

Although Egypt is a leading cotton producer, textile output has been dogged by overstaffing, outdated technology and a lack of quality control owing to the State’s monopoly on most spinning and weaving activity. State firms account for 30% of total manufacturing employment. By contrast, the ready made garment industry, 90% of which is owned by the private sector has boomed and manufacturing for international franchising, largely for export, is growing in popularity. In December 2004, Egypt signed an agreement with Israel and the US for the establishment in Egypt of seven qualifying industrial zones allowing goods to be exported duty free to the US provided they contain an 11.7% minimum proportion of Israeli input.

The composition of merchandise exports has changed markedly in the past few decades. Between 1965 and fiscal 2004, the share of agricultural commodities in total exports including items derived from cotton, dropped from 71% to 9%. Superseded by hydrocarbons, minerals, metals and manufactured goods reflecting the process of industrialization and the development of building and industry. In June 2004, a tortuous 8 years after negotiation first began, a wide ranging association agreement with the EU came into affect. Although the accord covers political, security, economic, social and cultural ties, the single most important aspect of the accord is far-reaching trade liberalization. The agreement gives Egyptian industrial goods immediate duty free access to the European market. It expands the quotas for some Egyptian agricultural exports and extends the agricultural export calendar. In return, Egypt will gradually phase out customs duties on EU industrial goods, tariffs on raw materials and capital goods for industry must be eliminated within three years.

The impact of the world trade organization continues to be of interest and concern to Egypt. If the necessary improvements that are projected continue to be developed, Egypt would be expected to enjoy greater
opportunities and to obtain higher prices for its textiles, cotton and food exports.

Both the US and the EU have made major investments in the construction of waste water projects in Helwan, south of Cairo, and in Alexandria as well. Another massive project that’s taking place in the southern valley development project is often known as the Toshka project. This highly ambitious plan aims to create an alternative delta parallel to the Nile valley involving large scale land reclamation linked to industry, tourism and mining projects and the creation of new urban communities to relieve congestion in the Nile valley. When completed, it is envisaged that the project will use 5 billion cubic meters of water per year which will come from Egypt’s Nile water allowance of 55.5 billion cubic meters of water per year. It is intended to cultivate 800,000 to 2 million feddans.

The Southern Valley scheme is part of a much larger national program to increase the amount of habitable land from 4% to 25%. The program which has been constrained by cost consideration includes 150,000 rain fed feddans on the NW coast as well as in areas along the river Nile, the border area with Sudan and other areas which are fed by ground water such as East Oweinat in the western desert. The Al Sala’am canal, inaugurated in 1997, will carry water from the Nile near Dumat under the Suez canal to south Al-Arish in northern Sinai and irrigate 620,000 feddans of desert.

Agriculture is an issue as a local food source, for international trade, for balance of payments, land use and water use and as a basic product for food and fiber manufacturing. Hence every aspect of the economic structure of a country relates to agriculture. Banking, transportation, tax and tariff structure, subsidies, local and international markets and health are all part of the agricultural system of a country. Not to mention politics, of course. (Data from The Economist Intelligence Unit, Ltd for the year 2005) (28)

**Rapid agricultural growth results in the quickest employment growth**

Development research across a broad array of countries suggests that rapid agricultural growth results in the quickest employment growth, so it is the best entry point for ensuring that economic growth is broadly participatory and hence equitable. The difference between rapid (4.8 percent per year) and slow (2.8 percent per year) growth in Egyptian agriculture represents 300,000 more jobs per year. About 60 percent of those additional jobs are in the rural non-farm consumer goods and services sector, 15 percent are in agricultural production, about one-fourth in the agribusiness input and output marketing activities.
The rural non-farm sector is almost entirely a producer of non-tradable goods and services and occupies 44 percent of the labor force. Agriculture is the dominant source of increased demand for the rural non-farm sector. Without rapidly rising farm incomes, the essential increased demand for the goods and services provided by the employment-intensive rural non-farm sector will not exist. Agricultural growth can be accelerated to achieve nearly a 5 percent growth rate through increased productivity, efficiency, and competitiveness. Such a growth rate, with its profound impact on employment growth, requires major improvements in policy matters.

Policy reform and implementation in Egypt are gradual processes, but processes that have seen important changes in the structure and operation of the agricultural sector. Egyptian agriculture is now more responsive to domestic and international market forces, less constrained by government involvement in production and marketing decisions, and more open to competition than ever before. Much of this progress stems from USAID’s commitment to high quality policy analysis and reforms, constructive interaction with the government and private sector, and detailed monitoring and evaluation. However, policy constraints continue to prevent Egypt from fully realizing the comparative advantage it has in most commodity systems. The challenge of reform is not completed, but the environment in which policy reform and its implementation occur is changing rapidly in Egypt.

Factors requiring policy change

First, as Egypt becomes more integrated into the global economy, its policies must conform to the requirements of WTO, exchange rate policy, reform of the Customs Service, and reduction of State involvement in trading.

Second, global competition places a premium on policies that could reduce production and marketing costs through more efficient customs services, efficient use of natural resources such as water, and access to low-cost production inputs.

Third, the growing role of the private sector is the most dramatic change affecting how policies are formulated and implemented. Business and trade associations are becoming a major force in the policy process. However, these associations are not yet capable of fulfilling this policy advocacy role entirely on their own.

Finally, given this assessment’s emphasis on fast growth in agriculture as a prerequisite for large increases in farm and rural non-farm employment, the lack of a policy focus on the productivity and competitiveness of smallholders is a serious shortcoming. For example, current cotton policies create major distortions in this system and deserve continued
engagement. Other significant policies include sanitary standards in livestock that are not science-based and those that impede the importation and registration of cultivars in horticulture.

There should be a concerted effort to transfer policy analysis capabilities to Egyptian institutions, public and private, over the coming years. The progress of trade associations holds promise as one element of this strategy. Programs promoting high value non-traditional agricultural exports (NTAE) have initiated a new era in Egyptian horticulture. Although exports of the major traditional products—potato, orange, and dried onion—have declined, NTAE products are being successfully commercialized. They are projected to account for more than one-third of the increase in total horticultural export volume in the current decade (more in terms of value) and to increase in importance as production increases.

The Horticultural Export Improvement Association, an association of growers, exporters, and service organizations, is providing marketing information and support, technical services, and policy analysis and advocacy for continued improvements in the enabling environment. It follows that the best long-term growth strategy for the horticultural subsector is to work to expand the domestic and export markets for both fresh and processed products (especially through value-added innovation), while upgrading the quality, safety, and consistency of supply of small, medium-sized, and large operators.

Livestock and fisheries together make up 24 percent of value added in the agricultural sector. Livestock represent about two-thirds of that total and, within livestock, milk and associated meat account for over half of the livestock sub-sector. Women dominate livestock production, and marketing. Production is predominantly on small farms. There is a powerful interaction of livestock and crop production, with substantial area devoted to the principal high-quality roughage, berseem. Rapid growth in livestock will increase the demand for maize as feed. Maize is already an important import. The levels of efficiency and productivity in this sub-sector are low. There is immense scope to reduce costs of production and increase competitiveness. The private sector marketing and feed distribution channels and facilities are poorly developed, as are the support systems for improving technology development and application.

Livestock and dairy in particular are the number one opportunities in the whole Egyptian economy to have an impact on women’s incomes and to develop their entrepreneurial capabilities.

How to accelerate the growth in demand for labor

A now large literature points to accelerated growth in the agricultural sector as the basic determinant of increased demand for labor. Martin Ravallion (82) and his colleagues at the World Bank and Peter Timmer
(94) and his colleagues, show that it is rural and agricultural growth, not urban or industrial growth, that reduces poverty and increases demand for labor.

These findings are consistent with the fact that agriculture drives the demand for labor through its demand for goods and services produced in the large, labor-intensive, rural non-farm sector. There is a large literature (Carl Liedholm (53 & 54) that shows the rural non-farm sector as dependent on agriculture as the driving force for its demand, and that the goods and services produced by the non farm sector are largely non-tradable. That means that their goods are not salable in the international market because of low quality and high transaction costs. Hence the non-farm sector depends on increased domestic demand for their growth.

There is also an employment-intensive, non-tradable sector in urban areas that is driven by demand from growth in the urban tradable sector. However the urban non-tradable sector is only half the size of the rural non-tradable sector.

Since land is a major factor in agricultural production and is very limited in the extent to which it can be increased, it follows that technological change is the primary source of agricultural growth. Capital dominates the urban tradable sector and is the primary determinant of its growth rate.

The Determinants of Demand for Labor and the Wage Rate

With high balanced growth, that is, both the agricultural and urban tradable sectors growing quickly, the demand for labor grows rapidly. If the source of rapid urban tradable growth is maintained at a high level, but the basic source of agricultural growth is eliminated, then agriculture does not grow at all. The demand for labor grows hardly faster than the labor force growth.

Wage rates and the income of the labor class Egyptian Data for the Model

The most important numbers for the model are those for employment. The 1998 CAPMAS survey (19) of the labor force provides detailed data that facilitate division of the labor force into the sectors described. Those data show 23 percent of the labor force is in agriculture, 15 percent in urban tradable and 62 percent in non-tradable, of which 42 percentage points are in rural non-tradable and 20 percentage points in urban non-tradable. The rural non-tradable sector dominates employment.

National income statistics are not tabulated according to tradable and non-tradable sectors, or even rural and urban, hence it was much more difficult to make that division. A firm figure is available for agriculture
value-added as a percent of total GDP. That is 17 percent. It is estimated from the expenditure patterns of rural people that 18 percent of GDP is produced in the rural non-farm sector. The urban sector was divided, largely on the basis of size of enterprise, with 57 percent of GDP in the tradable sector and 8 percent in the non-tradable. Note that the rural sector has nearly twice as high a share of employment as GDP, while the opposite relation holds in the urban sector.

Concisely, the structure of growth makes a tremendous difference. When agriculture grows rapidly, demand for labor grows rapidly; when urban tradable grow rapidly, GDP grows rapidly. A structure weighted towards agriculture is weighted towards benefits to labor; a structure weighted towards urban tradable items is weighted towards fast growth in GDP. It is agricultural growth that increases the income of labor. It does so through its impact on the demand for the goods and services of the rural non-tradable sector.

It should also be noted that agriculture and urban tradables grow in quite different ways. They are not fully competitive for resources. Urban tradables grow primarily through increase in the capital stock. Rapid growth in this sector may well require creating a favorable environment for foreign direct investment. Agriculture grows largely through technological change. Rapid growth of agriculture requires investment in research and extension. It should also be noted that in a model of this type, factors of production move readily across the economy in response to relative prices, and goods move readily into the export market when domestic production grows faster than domestic demand. In practice, policies must be in place not to impede, but to facilitate, those flows. (37, 54)

The Urban-Rural Story in Developing Countries-- According to UNFPA

Defining the basic terms “urban” and “rural” in a universal way has always been problematic. As globalization advances, the division of human settlements into “rural” and “urban” can also be seen as increasingly artificial. Better transportation and communications bring cities, villages and farming areas ever closer. Rural areas come to look more like towns, while informality is transforming cities’ housing, services and workforces, and even production and consumption. (95)

However, very few developing-country cities generate enough jobs to meet the demands of their growing populations. Moreover, the benefits of urbanization are not equally enjoyed by all segments of the population; left out are those who traditionally face social and economic
exclusion—women and ethnic minorities, for example in India the Government plans to assume the responsibility for providing a legal guarantee for 100 days of employment in every financial year for every rural household with an adult member willing to do unskilled manual work. It remains to be seen what impact this will have on rural-urban migration.

The Balance Between Urban and Rural Living and Work

Until recently, rural settlements were the epicenter of poverty and human suffering. All measures of poverty, whether based on income, consumption or expenditure, showed that rural poverty was deeper and more widespread than in cities. Urban centers on the whole offered better access to health, education, basic infrastructure, information, knowledge and opportunity. Such findings were easy to understand in view of budgetary allocations, the concentration of services and the other intangible benefits of cities.

There is evidence that the difficulty of securing title to property in rural areas is prompting women to migrate to cities in hopes of securing property there, where prospects are assumed to be better. If we want families to live in rural areas we have to provided the living conditions that enable their development including television and internet. The conclusions are that the rights of the poor to the city and to its benefits are often severely restricted and that the advantages of the urban poor over rural populations are surprisingly small in many developing countries.

Treating “rural” and “urban” poverty as somehow separate and in competition with each other for resources is not only a conceptual mistake, but a remarkably short-sighted view of the problem. In fact, successful rural development generally stimulates and supports urban development. Conversely, urban growth is a powerful stimulus to food production, especially by small farmers. Access to flourishing urban markets contributes both to the reduction of rural poverty and to urban food security.

In many regions, people are forced to leave rural areas. Population growth and environmental change may have depleted the natural resource base and its capacity to support local residents. Moreover, insecurity due to civil strife also compels many rural people to flee to the cities or their environs. Thus, for many, moving to the cities is not only rational but sometimes the only way to survive.

The need to safeguard environmental and agricultural land from chaotic urban expansion is a genuine concern. However, most cities still have
build able land in good locations, but it may be owned or controlled by private interests or by state agencies with no interest in socially directed uses of the land. The real shortage is thus not of land, but of serviced land at affordable prices.

However, most urban sites are critical parcels of land. Their increased rate of expansion, and where and how additional land is incorporated into the urban make-up, has significant social and environmental implications for future populations.

Many cities are situated at the heart of rich agricultural areas or other lands rich in biodiversity, the extension of the urban perimeter evidently cuts further into available productive land and encroaches upon important ecosystems.

With world population at 6.7 billion people in 2007 and growing at over 75 million a year, demographic concentration into cities gives sustainability a better chance. The protection of rural ecosystems ultimately requires that population be concentrated in non-primary agricultural lands and densely populated areas.

In developing countries, cities of 100,000 or more occupy areas of 200,000 km². They are expected to triple their built-up land area to 600,000 km² in the first three decades of this century. Cities in developed countries expand at an even faster rate per resident, despite their smaller population size and lower rate of population growth. They will increase their built-up land area by 2.5 times between 2000 and 2030. At that point, they will occupy some 500,000 km². Recent trends to lower densities may accelerate as globalization has its effect on lifestyles and production processes. Whatever the case, the data show that developing countries now share the trend to urban sprawl.

**Residential Suburbanization and Peri-Urbanization**

Urban sprawl results from the combination of different types of pressures on territorial expansion. For purposes of simplicity, these can be classified into two groups: residential suburbanization and peri-urbanization.

Peri-urban (urban fringe) areas often provide more accessible housing for poor residents and migrants in informal and scattered settlements. Poor settlements in such areas tend to be more insecure and subject to removal, while their residents generally lack services and infrastructure. They compete with agriculture for space, and both can be displaced by other economic uses. Land conversion, market opportunities, and rapid flows of labour, goods, capital and wastes force land prices up. Peri-
urbanization also increases the cost of living for the original rural population.

Agriculture is booming in urban and peri-urban areas. Farming in and around cities is a vital livelihood strategy for the urban poor; it provides nutritional health, income for other household expenses and mitigates some of the ecological problems of growing urban areas. The downside is that peri-urban continues to be illegal in parts of the developing world, and many local authorities are slow to recognize its important role. As primary producers of food crops in many developing-country cities, women stand to gain or lose the most as the future of this activity is determined.

Peri-urban areas encompass a wide range of activities, including farming, husbandry and cottage industries, together with industrial expansion, land speculation, residential suburbanization and waste disposal. They fulfill other key functions for urban areas, from the supply of food, energy, water, building materials and other essentials, to the provision of ecological services such as wildlife corridors, microclimates and buffer areas against flooding. This involves a complex readjustment of social and ecological systems as they become absorbed into the urban economy. Environmental degradation is also an issue in peri-urban areas. Specific health hazards arise when agricultural and industrial activities are mingled with residential use.

Global Environmental Change

Global environmental change (GEC) is the sum of a range of local, national or regional environmental challenges. The issue of water is particularly relevant in this discussion. The dependence of cities on a guaranteed supply of water makes significant demands on global fresh water supplies. Cities already compete with the much larger demands of agriculture for scarce water resources in some regions.

Urban areas can affect water resources and the hydrological cycle in two other main ways: first, through the expansion of roads, parking lots and other impervious surfaces, which pollute runoff and reduce the absorption of rainwater and aquifer replenishment; and, secondly, through large-scale hydroelectric installations that help supply urban energy need.

From a demographic standpoint, urbanization accelerates the decline of fertility by facilitating the exercise of reproductive health rights. In urban areas, new social aspirations, the empowerment of women, changes in gender relations, the improvement of social conditions, higher-quality
reproductive health services and better access to them, all favor rapid fertility reduction.

The projected expansion of the urban population in Asia and Africa, from 1.7 to 3.4 billion over a period of only 30 years, and the reduced level of available resources, stress the need for a more imaginative but pragmatic response.

CHAPTER 10

A MODEL FOR FEASIBLE GROWTH RATES

Now that we understand that agricultural growth is not only important to growth in national income, but also absolutely vital to growth in employment and reduction of poverty, we turn to look at what can happen in Egypt under various conditions of management, policy change, commodity choice and use of technology. A model system demonstrates these effects for Egypt in tables 1 to 10. This “model exercise” is intended to determine feasible growth rates that will have a substantial effect in raising employment growth rates.

“Model Exercise” Evaluates Feasible Growth Rates

Farmers make decisions about resource allocation among specific commodities. Much of investment, institution building, and policy are also commodity specific. The importance of each commodity group in the overall growth rate is a function of two factors: (1) the base weight; and (2) the growth rate. Very high growth rates are often possible for commodities that have only lightweight in the base. In those cases, even a high growth rate has little effect on the overall growth rate. The five agricultural commodity groups into which agriculture is divided for this assessment are (1) cotton; (2) cereals; (3) horticulture; (4) livestock; and (5) other crops. Miscellaneous is a mixture of diverse crops ranging from sugar cane to oilseeds to berseem (which is in effect covered by livestock). The commodity chain analysis treats each of the four commodity groups and will demonstrate the need for integrated policies specific to each commodity group. For each commodity group, different judgments are made about the composition of that growth.

For all of these commodity groups, two inputs, water and fertilizer, are particularly important to achieve strong growth rates. Fertilizer is already used at very high rates in Egypt. There is no scope for a major increase in production from radically increased rates of fertilization. But there is scope for significant increase in farm incomes through increased
efficiency of fertilizer use even as total usage increases modestly. Increasing the efficiency of fertilizer use will favor higher farm incomes as well as being environmentally sound. Efficiency of water use is also critical to achieve strong growth rates.

**Reaching Income Growth of 4%**

Using the base weights of each of five commodity groups as a percent of agricultural GDP and the target growth rates for each commodity group (Table 1) leads to a weighted average for the growth rates of 4.8 percent. That is an agricultural growth rate consistent with a 7.1 percent rate of growth of GDP as well as with 2.4% increase in employment. It is far higher than Egypt has achieved in recent decades. That growth rate, will increase employment at a rate more than two percentage points faster than the labor force growth rate (4.4% employment growth rate compared to 2.2% growth in labor force). It would be expected to provide rapidly rising real wage rates within 10 years.

Simplistically, the commodity groups are differentiated according to whether they are tradable commodities (the market is global) or non-tradable (the market is domestic) (Table 2). Cotton, Cereals, and Other Field Crops are designated tradable commodities. In theory, for these crops, demand at current prices is not a constraint because the global market is available, in the form of exports or displacement of imports. In that case, production forces determine growth. However, even on the international market, there are complex marketing problems that must be solved, including reducing transaction costs and providing the product quality demanded in the international market.

Horticulture and Livestock/Fisheries are classified (Table 2) as non-tradable. They represent well over half of value added in agriculture and a much higher proportion of employment. They are in need for integrated technical assistance that cuts across both the production and the marketing functions.

In the case of non-tradable commodities, it is growth in domestic demand that sets a rough ceiling on output growth (Table 3). With the non-tradable, lower consumer prices are required if consumption growth is to exceed the growth rate of domestic demand. The production target for livestock is consistent with the demand growth rates, and that for horticulture assumes sufficient relative price decline to allow consumption growth one percentage point faster than demand growth.

For horticulture, exports of new or non traditional crops now make up an insignificant 4 percent of production. Although exports are targeted to grow rapidly, the bulk of production is unsuitable for export markets. Thus, the determining constraint on output growth is domestic markets. As success is achieved on export markets with non traditional crops, horticulture will become increasingly a tradable commodity with demand not constrained by the domestic market. Horticulture uses rather little
land relative to its value of output, thus increasing area at the rate shown is not a substantial constraint if farmers find the crop profitable.

Domestic demand growth is estimated for Horticulture and Livestock/Fisheries (table 3). The domestic demand is calculated as a function of the population growth rate, per capita income growth, and the income elasticity of demand. Rapid agricultural growth is in part dependent on balanced growth. The export-driven urban sector must grow rapidly not only for its important contribution to GDP growth, but also to help provide effective demand for large non-tradable elements of the agricultural sector.

Livestock/Fisheries (because of the very rapid growth over the past decade, fisheries now make up about one-third of the total) is clearly non-tradable. There are imports, but they are only a small percent of domestic production and concentrated in specified sub-sectors. The difference between import parity prices and export parity prices largely stems from costs of marketing.

The income elasticity of demand is for Egypt as a whole and is derived from an IFPRI household survey. Income Elasticity of Demand measures the rate of response of quantity demand due to an increase (or decrease) in a consumers income.

The formula for the Income Elasticity of Demand (IED) is given by: 

\[
\% \text{Change in Quantity Demanded})/(% \text{Change in Income})
\]

The per capita income growth estimate is based on the GDP growth rate of 7.2 percent (Table 9) and is only slightly higher than the 7.0 percent rate taken by the World Bank as a reasonable future target, population growth rate of 2.2 percent, and a 20 percent marginal savings rate on the per capita income. That provides a per capita income growth rate of 4.0 percent. That of course is very high compared with that of the past. However, this exercise is intended to determine feasible growth rates that will have a substantial effect in raising employment growth rates. This is a conservative estimate, given the assumption of a fast-growing agricultural sector; the strong multipliers to the large, employment-intensive, rural non-farm sector; and a high, export-driven growth rate for the urban sector.

Sources of Output Growth

A plausible breakdown of sources of output growth (Table 2) is divided into yield, area, and increased unit value, largely because they relate to different sets of interventions. For the tradable commodities, such estimates of what can be achieved on the production front indicate the volume for which marketing problems must be solved.

MALR has estimated past yield increases (output per unit area of land) at only 0.4 percent per year for the crop sector. Table 2 targets much higher growth rates in yields: 4.5 percent for cotton and 3.0 percent for each of
the other crop commodity groups, and 4.0 percent for livestock (output per animal.) A technologically mature country such as the United States can expect continuing research and its application to provide on the order of a 1.5 percent rate of growth of yields. However, even though high in general, Egyptian yields lag well behind what can be achieved with current technology. Thus, an additional 1.5 percent rate of growth of yields is postulated, in a sense representing catch-up with the current global state of technology. That would close the yield gap with more advanced countries by only 16 percentage points in 10 years. Nevertheless, to achieve this objective requires a substantial effort and focusing of the agricultural research effort. It probably also presumes a significant foreign private sector input.

In the case of cotton research, it has for over 20 years only maintained yields. Yields have not surpassed the levels of the early 1980s. The rest of the world has experienced steady increase in cotton yields. Thus, an additional 1.5 percentage points of catch-up growth is postulated. That comes to a very rapid 4.5 percent rate of growth. At that rate, it would take nearly 9 years to reach the current Israeli level of cotton production (table 4), by which time Israel would have moved onto substantially higher yields. To achieve this high growth rate in yields is not possible with a business-as-usual approach to cotton research. Considerably greater focus and expenditure are needed. The present research system has been effective in maintaining yields in the face of the usual forces tending to reduce them. It must now focus additionally on what is needed for rapid yield increase.

Similar statements can be made for other internationally traded commodities. Israel out produces Egypt in maize; Namibia in wheat and Australia in rice. These other three countries also have dry, sub-tropical climates, similar soils, and irrigation based agriculture. The yield differentials run from 17 percent higher than Egypt for rice to 45 percent higher for cotton.

Area expansion is targeted as important for cotton and for horticulture: 2.5 percent rate of growth of area for cotton and 2.0 percent for horticulture (table 2). In effect, it is assumed that those increased areas are comparable to the increased area from new lands that the government targets, net of losses of land to agriculture from urbanization and such forces. Thus, compensating decline in area of these crops is not shown. That in effect means that something on the order of 0.75 percent points, or 15 percent, of the 4.8 percent growth rate is attributable to the new lands. The importance of new lands is even greater, given the significant loss of land to non-agricultural uses that is netted out of the new lands in these calculations. In the case of horticulture, a shift to higher value components may be more important than increased area.
Cotton versus rice

Analysis by the GOE predicts the cotton area increasing by one-third in the near future and rice area declining commensurately. For that to happen will require major policy changes. A low point in cotton area was reached in recent years at less than half the area planted in the early 1980s. There has been some recovery from those low points, but recovery of past peaks would represent a nearly two-thirds increase in area from current levels. Reaching the commonly quoted government objective of 1 million feddans planted to cotton would require a one-third increase from present levels. Of course, the decline in area planted is a response by farmers to the relative profitability of cotton, particularly relative to rice. That is despite the very strong comparative advantage of Egypt in cotton production. Thus, much needs to be done with respect to policy if these targets are to be reached. It should be noted that cotton generates a far higher value added per unit area of land than the other field crops, so raising cotton production is important to the overall growth rate and to employment. It is assumed that Egypt will develop its absolute and comparative advantage in finer grades of cotton and increase the share of output from those higher value components. Egypt has a strong comparative advantage in extra-long staple cotton. Demand in the world is moving strongly toward high quality products and to some extent to natural products as well. That is a favorable environment for market development for extra-long staple cotton.

Constraints for livestock

Livestock production is shown to grow largely by increased productivity per animal, implying a doubling in animal productivity over an 18-year period. That is important to increasing competitiveness of the sector. Increasing production per animal also would increase feeding efficiency. In addition, there would be an increase of concentrate feeding, possibly from increased imports. Thus, what happens to the berseem area is indeterminate, particularly because berseem yields should also be presumed to increase at a 3 percent rate, as for the other field crops. With that rate of yield increase for berseem, some relative increase in concentrate feed use, and an increasing feeding efficiency, it is unlikely that berseem area would have to expand to match the livestock growth. Again, however, there is a heavy burden placed on productivity-increasing research and its application to small farms. Livestock output is in terms of value added, that is net of the feed consumed.

Production and marketing constraints

The high-income elasticities assumed for livestock and horticulture are mirrored by high-price elasticities. (% Change in Quantity Demanded)/(% Change in Income) That means that if the production and marketing constraints are not removed, the consumer price will rise and
consumers will shift readily to other, largely non-agricultural commodities. Given the labor intensity of livestock and horticulture and the strong employment multipliers, that lost opportunity will be paid largely in the form of less growth in employment and less decline in poverty.

Conversely, if production costs can be reduced substantially, that benefit can be shared with consumers, with the lower prices increasing consumption and providing the possibility for a higher growth rate. International competitiveness requires steady, substantial reduction in production costs.

Growth in farm incomes of the magnitude required for rapid growth in employment cannot occur without large increases in farm output. However, the marketing of that increased production, even in global markets, will not occur automatically. In both the global and the domestic markets, there are a myriad of complex marketing problems that must be solved.

Response to technology and globalization

Egypt has highly productive agricultural resources that are reflected in high crop yields. Such conditions are normally highly responsive to the new opportunities offered by technological advance and the forces of globalization.

A common means of measuring comparative advantage is to compute the domestic resource cost of production. The domestic resource costs (DRCs) computed specifically for this assessment are summarized in Table 5. A country has a comparative advantage if the DRC is less than one. All the crops in Table 5 show a DRC of less than one.

The two horticulture crops, potato and tomato, undoubtedly are representative of a wide range of vegetables and fruits, reflecting extremely high comparative advantage. They also show by far the highest returns to water. Hence, the future is bright for major expansion in these commodities. The proportion of area planted to these crops is very small compared for example with that of Southern California, with its comparable climate, soils, and water.

Cotton and wheat show very low DRCs of 0.61 and 0.65. Short season berseem, which is in part a proxy for livestock, shows an exceptionally low DRC of 0.37. Maize also shows a highly competitive DRC of 0.81. Rice, Sugar Cane, and Sugar Beet show competitive DRCs, comparable to that of Maize. However, as shown in the last column of Table 5, the returns to water for these very water using crops is very low, at one-third or less that of cotton. At such time as water becomes more scarce than at present, these high water consuming low returns to water crops will become less and less competitive for resources. An area of rice much less than at present, but nevertheless substantial, will remain competitive.
because it is grown on very heavy soils, ill suited to other crops, and much less demanding in water use.

A separate calculation in a World Bank study, for livestock, shows DRCs of 1.0 or lower for poultry, both home and commercial; buffalo; and exotic cattle (Table 6.) It is notable that Baladi (local) cattle show negative returns—but that is most likely a reflection of farmer’s willingness to take well below market wages for work on cattle. That suggests that the real profitability of cattle to farmers is much higher than shown in Table 6.

Opportunities and Constraints per Commodity

The next section discusses opportunities and constraints for each commodity group. The following brief exposition points out critical differences among the commodity groups in constraints to be removed.

Cotton

In the target growth rates presented in Table 2, cotton accounts for only 11 percentage points of the increments to agricultural production. That is because of its low weight in the base of production and that in turn is because the area and production of cotton have declined precipitously over the past few decades. That decline does not represent lost comparative advantage (as shown by the DRCs in Table 6) but unfavorable policies. Thus, the 9.0 percent growth rate for cotton is very rapid by normal crop growth standards but not unreasonable considering how powerful the negative policy effects have been. Note that Pakistan, also a large producer of cotton under conditions similar to those of Egypt, sustained a 16 percent growth rate in cotton production for well over a decade in the 1970s and 1980s.

Cereals and other Field Crops

Cereals account for 7 percent of incremental growth in the scenario set forth in table 3. In the recent past, rice has expanded its area substantially at the expense of cotton. That would be reversed by change in policy. Yield growth depicted requires attention to research and extension. Other Field Crops are depicted as growing at three percent per year, only because of increased yields.

Horticultural Crops

A growth rate of 6 percent is shown for horticulture but that will not be easy to achieve. First, a vigorous research and extension effort is needed to bring down cost of production. Second, massive barriers to competitive marketing must be removed. Thus, although the large-scale farms on the new lands can blaze a path, the large number of smallholders in the Delta must be included. That very much affects the approach to both extension and marketing. Finally, although the bulk of
horticulture production will continue to be non-tradable on quality and transaction cost grounds, the export sector must grow quickly and increase the proportion of total production made suitable to the export market. In the long run, a high proportion of the Delta needs to be brought under horticulture production and that means small holders must be brought into the process. In Egypt, 15 percent of the cropped area is under vegetables and orchards. That compares with more than twice that proportion in the San Joachim Valley counties of California.

**Livestock**

Finally, livestock are produced primarily on small farms, and women play a major role in livestock production and marketing. Smallholder livestock is highly labor intensive. There is some view that the smallholder sector is inefficient. That is partly an image problem because the small farmer uses less capital and much more labor in the production process. It is also a reality because smallholders do not receive significant research, extension, and market development attention. But with 27 percent of incremental value added projected to come from livestock, and that amount only matching demand growth, it is essential to income and employment growth that this potential be realized.

**Efficiency of Input Use**

*Fertilizer*

Typically in high-income countries value added in agriculture rises more rapidly than gross value of output. In contrast, in low-income countries the reverse is the case. That is because of the rapid increase in fertilizer use with little attention to the management-intensive practices that increase the productivity of fertilizer. Three hypothetical cases illustrate the third situation which represents Egypt (Table 7). Because the efficiency with which fertilizer is used is decreasing with growth in use, value added grows substantially less rapidly than total output. The countries that achieve faster growth in value added than in gross value of production have substantial research and extension programs focused on increasing input efficiency.

It is value added that matters to farm incomes, which in turn drives rural employment. Thus, Egypt, which uses fertilizer at rates far higher than typical low-income countries (but of course still less than in the high-income countries), has considerable scope to increase the productivity of fertilizer. It should be noted that in effect the employment impacts shown below presume that value added will grow as rapidly as gross value of output, Situation 2 in the table, which in turn presumes an effective effort to improve the management of inputs, especially fertilizer.
Water

The targeted growth rates presume that the cultivated area will continue to expand at about the same rate as in the past few decades. In those calculations, the government’s targets for new irrigated area have been accepted and then the historical rate of loss of agricultural land netted out; that leaves a net growth rate of about 0.75 percent. There is an implicit assumption that new lands will be allocated optimally and will be comparable in quality to past additions. It also is assumed that sufficient increase in water use efficiency will occur to meet the rapidly growing urban needs without productive loss in agriculture. These are all heroic assumptions. For them to become reality will require continuing attention to water use policy and the making of hard decisions about where new water will be allocated. In this context, difficult conflicts between the best allocation for employment and national income growth and broader national objectives will have to be resolved.

Achieving the Comparative Advantage

The assumptions stated above provide an agricultural growth rate of 4.8 percent. That is in the mid range of the 4-6 percent growth rates typical of the high-growth-rate countries (Mellor 68). That is a reasonable position for Egypt’s highly biological technology-responsive agricultural resources. As is shown in the next section, that growth rate makes a major contribution to employment growth and poverty reduction. The contribution of agriculture is a function of the per capita rate of agricultural growth. Thus, with a 2.2 percent population growth rate and a 4.8 percent agricultural growth rate, reducing the agricultural growth rate by one percentage point reduces the total output growth rate by about 20 percent but the growth rate per capita by nearly 40 percent. Thus, there is urgency to finding the means to meet the high growth rate target. The comparative advantage is there. The need is for the investment, the institutions, and the policies delineated in detail in the following sections.

Investment and Institutional Development

If this high agricultural growth rate is to be achieved, specific investment and institutional development efforts must be made in each commodity group. This assessment recommends that USAID play an important commodity-specific role in the two most important commodity groups for achieving the high growth target—horticulture and smallholder livestock.

Policy Changes

Of perhaps even greater importance than the commodity-specific efforts is a large, continuous effort to realize the policy changes that are needed at the macro level, at the general agricultural level, and
at the specific commodity level. That effort requires continuous analysis of the changing policy needs, related to the priorities for achieving the overall growth rate, an effective implementation of policy change, and continuous monitoring and evaluation of progress made. The last is of special importance because of the dynamic nature of the changes and the need to understand the shifting policy priority needs in the context of a dynamic technological and commodity growth situation.

The Effect of Not Achieving the Comparative Advantage

If in each category in Table 1 the growth rate dropped in half, except for cereals for which the growth rate would be maintained at 3 percent per year due to increased new lands, but reduced yield rate growth. The overall growth rate would be 2.7 percent—comparable to the growth rate in previous slow agricultural growth periods and a level just keeping up with labor force growth. The difference in impact between the 4.8 percent and the 2.7 percent growth rates is calculated in Table 10.

The growth rate of GDP would fall little: by only 12 percent from 7.2 to 6.3. That is not surprising because agriculture is a small part of the total economy. However, most important, 329,000 fewer jobs would be created. Job formation would decline by 33 percent, compared to the decline in GDP growth rate of 11 percent. Because it is assumed that the growth rate would not decline in the urban sector, 56 percent of job formation would be in the urban sector, primarily in the metropolitan areas that are dominant in exports and only 47 percent in the rural areas. Rural urban migration would be much greater than under the fast agricultural growth scenario.

The rural economy would be devastated by slow agricultural growth. With agriculture growing at 4.8 percent and high employment growth, the farm population would decline on the order of 0.5 percent. Farm incomes would rise by a full 5 percent per year; they would double in 14 years. With 2.7 percent growth and slow growth in employment, the farm population would probably increase by nearly the amount of population growth and hence farm incomes would not increase at all.

With the low-growth rate, rural areas would experience both stagnant farm incomes and 329,000 fewer jobs created each year. The consequent rural-urban income differentials would certainly result in massive rural-urban migration. Many of those migrants would flood into urban slums and wait for considerable periods for the better-paying urban jobs. That would be one of the most important causes of increased urban poverty and slums.

If agriculture grows at only the labor force growth rate and the urban sectors grow as above, the overall employment growth rate drops to 3.4 percent or by nearly 30 percent. It would then take nearly 17 years to absorb the same pool of underemployed as would be absorbed in 5 years in the fast agricultural growth strategy.
Summary—Providing 1,000,000 New Jobs per Year

Thus, the solution to Egypt’s employment problem can be met only with major efforts in agricultural employment as well as accelerated growth of the urban, tradable goods and services sector. It is not a matter of one or the other, it is a matter of the total of both sectors. The urban is essential because it has a large share of GDP and accounts for substantial employment, and also because it is important to growth of the non-tradable sub-sectors of agriculture—particularly livestock and horticulture.

In contrast, agriculture’s small share of GDP looms large as a share of employment. In turn, each commodity group within agriculture has a significant role to play in employment growth. Failure to move any one brings a significant effect on employment growth, but none is so dominant that one can concentrate on only that group. Thus, the place for priorities is emphasizing the large components within each sub-sector and diagnosing the few priorities for advancing each sub-sector.

Remembering that the policy environment must be favorable to advancements in the scientific disciplines that will provide the technology needed for an efficient food and fiber system.

The importance of the task is challenging and enormous. A recent statement from the Office of the Minister of Commerce and Industry of Egypt in July of 2007 estimated that one million new jobs are needed in Egypt each year.
Table 1 Target Agricultural Growth Rates by commodity Group, 1999

<table>
<thead>
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<th>Commodity Group</th>
<th>BW</th>
<th>GR</th>
<th>PG</th>
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<td>4.8</td>
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AVERAGE

BW = base weight  
GR = growth rate  
PG = proportion of growth

Table 2: Target sources of Growth by Commodity, Hypothetical

<table>
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<th>Commodity Group</th>
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<th>GR%</th>
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<th>AGR</th>
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<td>9.0</td>
<td>4.5</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>CEREALS</td>
<td>23</td>
<td>3.0</td>
<td>3.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>HORTICULTURE</td>
<td>31</td>
<td>6.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>LIVESTOCK/FISHERIES</td>
<td>24</td>
<td>5.3</td>
<td>4.0</td>
<td>1.3</td>
<td>0</td>
</tr>
</tbody>
</table>

AG% = agricultural GDP %  
GR% = growth rate %
YGR = yield growth rate
AGR = area growth rate
UVGR = unit value growth rate

Table 3: Demand Growth Under High, Balanced Growth Scenario

<table>
<thead>
<tr>
<th>Demand Component</th>
<th>Horticulture</th>
<th>Livestock/fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Growth, percent/year</td>
<td>2.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Per Capita</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Income Elasticity of Demand</td>
<td>0.69</td>
<td>0.77</td>
</tr>
<tr>
<td>Shifter from Lower Prices Demand</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Growth (calculated from above)</td>
<td>6.0</td>
<td>5.3</td>
</tr>
</tbody>
</table>
Table 4: Demand Growth Under High, Balanced Growth Scenario

<table>
<thead>
<tr>
<th>Crop</th>
<th>Country</th>
<th>Yield (Hg/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>Egypt</td>
<td>76,800</td>
</tr>
<tr>
<td></td>
<td>Israel</td>
<td>13,384</td>
</tr>
<tr>
<td>Seed Cotton</td>
<td>Egypt</td>
<td>27,551</td>
</tr>
<tr>
<td></td>
<td>Israel</td>
<td>40,000</td>
</tr>
<tr>
<td>Wheat</td>
<td>Egypt</td>
<td>63,566</td>
</tr>
<tr>
<td></td>
<td>Namibia</td>
<td>79,987</td>
</tr>
<tr>
<td>Rice, Paddy</td>
<td>Egypt</td>
<td>81,538</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>95,308</td>
</tr>
</tbody>
</table>
### Table 5: Domestic Resource Cost, Various Commodities

<table>
<thead>
<tr>
<th>Crop</th>
<th>Domestic Resource Cost</th>
<th>Value of Water (LE/1000 M³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>0.65</td>
<td>0.39</td>
</tr>
<tr>
<td>Short Berseem</td>
<td>0.37</td>
<td>0.51</td>
</tr>
<tr>
<td>Maize</td>
<td>0.81</td>
<td>0.17</td>
</tr>
<tr>
<td>Rice</td>
<td>0.83</td>
<td>0.09</td>
</tr>
<tr>
<td>Cotton</td>
<td>0.61</td>
<td>0.34</td>
</tr>
<tr>
<td>Potatoes, summer</td>
<td>0.18</td>
<td>1.10</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.81</td>
<td>0.11</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>0.77</td>
<td>0.06</td>
</tr>
<tr>
<td>Tomato, winter</td>
<td>0.19</td>
<td>1.13</td>
</tr>
</tbody>
</table>

### Table 6: Domestic Resource Cost, Livestock Products

<table>
<thead>
<tr>
<th>Animal</th>
<th>Domestic Resource Cost</th>
<th>Domestic Resource Cost, Berseem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle, exotic</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Animal Type</td>
<td>Na</td>
<td>Value</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Cattle, Baladi</td>
<td>Na</td>
<td>6.5</td>
</tr>
<tr>
<td>Buffalo</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Poultry, home</td>
<td>1.0</td>
<td>na</td>
</tr>
<tr>
<td>Poultry, commercial</td>
<td>1.0</td>
<td>na</td>
</tr>
</tbody>
</table>
Table 7. The hypothetical situations of agricultural growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross Value Output</th>
<th>Year</th>
<th>Cost of inputs</th>
<th>Value added</th>
<th>Cost of inputs</th>
<th>Value added</th>
<th>Cost of inputs</th>
<th>Value added</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>2</td>
<td>25</td>
<td>75</td>
<td>25</td>
<td>75</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td>3</td>
<td>26</td>
<td>78</td>
<td>25</td>
<td>79</td>
<td>26</td>
<td>78</td>
</tr>
<tr>
<td>3</td>
<td>110</td>
<td>4</td>
<td>27</td>
<td>82</td>
<td>26</td>
<td>83</td>
<td>28</td>
<td>81</td>
</tr>
<tr>
<td>4</td>
<td>115</td>
<td>5</td>
<td>29</td>
<td>86</td>
<td>27</td>
<td>88</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>121</td>
<td>6</td>
<td>30</td>
<td>91</td>
<td>28</td>
<td>93</td>
<td>33</td>
<td>89</td>
</tr>
<tr>
<td>6</td>
<td>127</td>
<td>7</td>
<td>32</td>
<td>95</td>
<td>29</td>
<td>98</td>
<td>35</td>
<td>92</td>
</tr>
<tr>
<td>7</td>
<td>134</td>
<td>8</td>
<td>33</td>
<td>100</td>
<td>30</td>
<td>104</td>
<td>38</td>
<td>96</td>
</tr>
<tr>
<td>8</td>
<td>140</td>
<td>9</td>
<td>35</td>
<td>105</td>
<td>31</td>
<td>109</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td>147</td>
<td>10</td>
<td>37</td>
<td>110</td>
<td>32</td>
<td>116</td>
<td>43</td>
<td>104</td>
</tr>
<tr>
<td>10</td>
<td>155</td>
<td>11</td>
<td>39</td>
<td>116</td>
<td>33</td>
<td>122</td>
<td>46</td>
<td>109</td>
</tr>
<tr>
<td>11</td>
<td>162</td>
<td>G</td>
<td>5.00%</td>
<td>5.00%</td>
<td>5.00%</td>
<td>3.00%</td>
<td>5.60%</td>
<td>7.00%</td>
</tr>
</tbody>
</table>
Section 1: Growth rate of cost inputs = Growth rate of gross value of output

Section 2: Growth rate of cost inputs < Growth rate of gross value of output

Section 1: Growth rate of cost inputs > Growth rate of gross value of output

table 8: GDP and Employment Proportion, By Sector, Hypothetical

<table>
<thead>
<tr>
<th>Sector</th>
<th>GDP Proportion</th>
<th>Employment Proportion</th>
<th>GDP Employment Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>17</td>
<td>23</td>
<td>0.74</td>
</tr>
<tr>
<td>Rural Non-tradable</td>
<td>17</td>
<td>43</td>
<td>0.39</td>
</tr>
<tr>
<td>Subtotal</td>
<td>(34)</td>
<td>(66)</td>
<td>(0.52)</td>
</tr>
<tr>
<td>Urban Tradable</td>
<td>56</td>
<td>14</td>
<td>4.00</td>
</tr>
<tr>
<td>Urban Non-tradable</td>
<td>10</td>
<td>20</td>
<td>0.50</td>
</tr>
<tr>
<td>Subtotal</td>
<td>(66)</td>
<td>(34)</td>
<td>(1.94)</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100</td>
<td>(100)</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>
Table 9: Employment and GDP Growth Rates by Sector Hypothetical

<table>
<thead>
<tr>
<th>Sector</th>
<th>GDP Proportion</th>
<th>Employment Proportion</th>
<th>GDP Employment Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>17</td>
<td>23</td>
<td>0.74</td>
</tr>
<tr>
<td>Rural Non-tradable</td>
<td>17</td>
<td>43</td>
<td>0.39</td>
</tr>
<tr>
<td>Subtotal</td>
<td>(34)</td>
<td>(66)</td>
<td>(0.52)</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>14</td>
<td>4.00</td>
</tr>
<tr>
<td>------------------</td>
<td>----</td>
<td>----</td>
<td>------</td>
</tr>
<tr>
<td>Urban Tradable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Non-</td>
<td>10</td>
<td>20</td>
<td>0.50</td>
</tr>
<tr>
<td>tradable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>(66)</td>
<td>(34)</td>
<td>(1.94)</td>
</tr>
<tr>
<td>Grand Total</td>
<td>100</td>
<td>(100)</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>
Sources: GDP growth; Agriculture from Table 2; rural non-far calculated as Agriculture GDP growth rate per capita times multiplier of 1.5, plus population growth rate; Urban Tradable assumed high rate; Urban Non-tradable, assumed same as Urban Tradable; Employment elasticity; Agriculture from Rao 1986; Rural Non-tradable, marginally less than one: Urban tradable, standard LIC industrial; Urban Non-tradable same as Rural Non-tradable; Employment Growth equals GDP Growth Rate times the Elasticity, Proportion calculated as average of Employment Growth Rae weighted by the employment proportion from table 7.
Table 10. Jobs Generated in the Rural and Urban Sub-Sectors, Fast and Slow Growth in Agriculture, 2002

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>4.8</td>
<td>121</td>
<td>12</td>
<td>2.7</td>
<td>68</td>
<td>10</td>
<td>53</td>
</tr>
<tr>
<td>Rural Non-tradable</td>
<td>6.1</td>
<td>494</td>
<td>51</td>
<td>2.7</td>
<td>218</td>
<td>34</td>
<td>276</td>
</tr>
<tr>
<td>Subtotal</td>
<td>(5.5)</td>
<td>(615)</td>
<td>(63)</td>
<td>(2.7)</td>
<td>(286)</td>
<td>(44)</td>
<td>(329)</td>
</tr>
<tr>
<td>Urban Tradable</td>
<td>8.0</td>
<td>91</td>
<td>10</td>
<td>8.0</td>
<td>91</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Urban Non-tradable</td>
<td>8.0</td>
<td>302</td>
<td>27</td>
<td>8.0</td>
<td>302</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Subtotal</td>
<td>8.0</td>
<td>(393)</td>
<td>(37)</td>
<td>8.0</td>
<td>(393)</td>
<td>(56)</td>
<td>0</td>
</tr>
<tr>
<td>Grand Total</td>
<td>7.2</td>
<td>1,008</td>
<td>100</td>
<td>6.3</td>
<td>679</td>
<td>100</td>
<td>329</td>
</tr>
</tbody>
</table>

PART SIX

HORTICULTURE CROPS ARE MORE VALUABLE THAN OTHER CROPS AND USE
LESS WATER PER VOLUME AND VALUE OF PRODUCTION

Egypt has a significant comparative advantage in the production and export of high value horticultural products, based on location, agro-climatic conditions, availability of land and water, and market access due to counter-seasonal production.

The new Food Export Council is convinced it can increase year 2005’s $500 million in exports to $3-4 billion within a decade. This included sales of olives, up 125%, while frozen vegetables climbed 56%, dairy 45%, olive oil 40% and juice 17%. Dairy, juices and concentrates and confectionery were the top-three processed food exports by chapter last year. While the focus is on exports, the Egyptian horticulture industry should not lose sight of the fact that there is also a growing demand for higher quality foodstuffs in the domestic market, led by five-star hotels, up-market restaurants, fast food chains and an increasing number of supermarkets.

For real success in horticulture, Egypt must take advantage of the most sophisticated scientific technologies, build an elaborate extension program and ensure that governmental policies compliment the total effort.

CHAPTER 11

THE FUTURE OF EGYPT--HORTICULTURE
Egypt enjoys a significant comparative advantage in the production and export of high value horticultural products. This comparative advantage is based on a number of factors, including favorable agro-climatic conditions, physical proximity to important markets and counter-seasonal production capabilities. The growth in industry cohesiveness and sophistication and an increasing awareness on the part of government toward the importance of private sector primacy in decision-making are also important factors.

Despite the significant growth in exports that has already occurred, a small number of Egyptian horticultural products still command a minor market share in a relatively few export markets. This indicates significant potential for further increases in sales to current markets as well as for entry into new markets.

Any analysis of export potential for Egyptian high value horticultural products must also take into account the market opportunities for
processed products. Another major opportunity for increasing horticultural exports is the rapid growth in world demand for organically and naturally grown foods. Egypt is very favorably situated to exploit these markets, particularly in those areas newly opened for cultivation, which have no history of agricultural chemical use. While the focus is on exports, the Egyptian horticulture industry should not lose sight of the fact that there is also a growing demand for higher quality foodstuffs in the domestic market, led by five-star hotels, up-market restaurants, fast food chains and an increasing number of supermarkets.

In order to fully capitalize on these opportunities, however, the Egyptian horticulture industry must overcome a number of policy, commercial and cultural constraints.

For horticulture, exports of new or non traditional crops now make up an insignificant 4 percent of production. Although exports are targeted to grow rapidly, the bulk of production is unsuitable for export markets. Thus, the determining constraint on output growth is domestic markets. As success is achieved on export markets with non traditional crops, horticulture will become increasingly a tradable commodity with demand not constrained by the domestic market. Horticulture uses rather little land relative to its value of output, thus increasing area is not a substantial constraint if farmers find the crop profitable.

For the Egyptian government and the agricultural industry to develop the horticultural industry to its potential for the export of non traditional crops and to meet the demands of a growing population in the traditional domestic market will require an exceptional level of planning, cooperation and technology.

**SWOT Analysis**

Hence step one is the analysis of the present situation. One tool for that step is the SWOT analysis. The SWOT Analysis is a strategic planning tool used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture or in any other situation of an organization or individual requiring a decision in pursuit of an objective. It involves monitoring the marketing environment internal and external to the organization or individual. The following SWOT analysis represents an amalgamation of Evaluation findings carried out by the Horticulture Export Improvement Association (43) (HEIA)

*Egypt’s Advantages*
• Egypt has a significant comparative advantage in the production and export of high value horticultural products, based on location, agro-climatic conditions, availability of land and water, and market access due to counter-seasonal production.

• The horticultural sector assisted by ATUT and other USAID projects is beginning to translate that comparative advantage into competitive advantage at the individual farm and agribusiness firm level.

• The larger grower-exporters served by ATUT, have become relatively sophisticated in production and marketing, and in order to increase their output, they are increasingly willing to help extend their knowledge to smaller-scale growers.

• The industry is also becoming increasingly cohesive, through the growth of trade associations such as HEIA.

• Horticulture crops are more valuable than other crops and use less water per volume and value of production; this is important given projections of potential shortfalls in water availability during the coming decade.

• There are utilized and underutilized opportunities to expand horticultural production.

**Egypt’s Challenges**

**Education, research and extension systems do not meet the needs of the horticultural industries.**

• Shortage of essential skills at all levels within the agribusiness sector, due in large part to the deficiencies of the education system.

• Lack of knowledge leading to failure to apply proper harvest, post harvest and marketing practices.

• Older lands are subject to high level of infestation from soil borne pests and diseases.

• Insufficient linkages between researchers and producers; lack of practical experience and lack of understanding of producer problems on the part of most researchers and an ineffective extension services. A lack of Choice in Varieties is a constraint. Tomato farmers are limited by the need for resistance to Yellowed Leaf Curl Virus (YLCV) and poor post-harvest handling systems. (AGERI-7) domestic horticultural market is constrained by a transportation and storage system that is very damaging to product quality. It is estimated that up to 40 percent of total production of highly perishable products are damaged or lost

• Poor infrastructure management.
Governmental Processes Need to be More Positive
- Onerous customs procedures.
- Government Accountability Project compliance delayed due to lack of a national strategy.
- Unwillingness of certain government officials/managers to abdicate commercial decision-making in favor of the private sector.
- Some remaining problems in sourcing imported planting materials and other agricultural inputs, including government restrictions on testing of seed and pesticides.
- The general antipathy that persists between the government and the private sector in Egypt makes it difficult to forge a fruitful partnership in which the capabilities of the two sectors can be exploited for the benefit of both the industry and the nation.
- The lack of cooperation among different government agencies.
- Land tenure problems associated with slow registration leading to inability to use land for collateral.

Lack of Adequate Market Intelligence
- Inadequate post harvest and marketing facilities.
- Absence of efficient market intelligence/market information systems/facilities.

Agricultural Leaders Must Take Responsibility for Major Issues
- Still too many instances of failure to meet foreign buyers’ quality standards.
- Insufficient volume of export quality horticultural commodities available to significantly influence most markets.
- Not enough investment in food processing.
- Lack of organization among small farmers.
- Imbalance in the relative influence between small farmers and traders over costs, price and marketing decisions.

Labor Problems—a Societal Issue
- Low productivity of Egyptian labor compared with that of competitors.
- Cultural bias toward women working after marriage (exists primarily at rural lower socio-economic levels).

What Can Be Done to Maximize Horticulture
(41, 50, 60, 61, 62, 63, 78, 86, 114, 115)
Future projects should involve the larger horticulture industry, including fresh exports, food processing, the domestic market and the various support and service industries. It should incorporate comprehensive measures for productivity improvement and integration of smallholders into the commercial horticultural sector including the export sub-sector. This will require a significant expansion in the provision of technology transfers and technical services. While improving production and harvest practices to increase productivity and improve quality will remain critical, equal emphasis must be placed on upgrading post harvest and marketing techniques and technology. Additional emphasis on all phases of marketing is also recommended. Specific components should also be incorporated to enhance industry utilization of information technology and to address policy issues involving genetic engineering to improve existing varieties and develop new varieties that will better meet market needs.

The initial competitive advantage of production and sales will not be maintained without explicit efforts to do so. Market prices are declining both absolutely and in relation to Egyptian prices. Egypt will have to reduce the delivered cost of its products to remain competitive. This will have to be accomplished through the adoption of new technologies for the following:

- production,
- post-harvest handling,
- transportation,
- developing economies of scale, and
- reduced taxes,
- meeting the market’s changing quality needs
- increasing the number of industry participants.

Role of Biotechnology and Patents

There is one topic that is an important consideration in every type of research affecting plants, animals, and microorganisms. That topic is biotechnology or genetic engineering or molecular biology. Whatever specific term one uses, it is a powerful tool for the modification of the genetics of an organism. It is an extremely important method of reducing pesticide overuse; it is a means of accelerating the development of new strains of beneficial microorganisms as well as plants and animals. However the almost miraculous benefits of the method bring with it the problem of misunderstanding and rejection. Many governments have
refused to examine the entire spectrum of benefits and concerns and hence of disadvantage their country. Hence specialists in the field have provided background information as an aid to the decision makers of interested countries.

The following recommendations are the basis for decisions regarding the adoption of technology by developing countries:

1. All countries should to be free to make their own decisions about adoption of biotech cotton or other products of modern biotechnology unconstrained by philosophical, ideological or economic pressures from outside.

2. Develop a centralized regulatory process that is clear, rigorous, expeditious, harmonized and science based, that requires testing to demonstrate benefits and follow-up procedures to ensure sustainability.

3. Ensure that legislation is in place to protect both the germplasm and the technology

4. Develop technical teams that can educate farmers and support the use of new technology.

5. Encourage the adoption of the best technology in varieties with demonstrated local performance.

6. Include biotech cotton as one component of an integrated farming system supporting adoption of IPM (Integrated Pest management) or IWM (Integrated Weed management), not as a replacement or alternative technology.

Arguments for and Against Biotechnology

According to Jonathan DG Jones of (108) The Guardian, Genetic modification (biotechnology) in agriculture is part of the solution, not part of the problem. He goes on to say, We live in a strange world. The so-called greens are opposed to a technology that substantially reduces the environmental impact of agriculture.

Consider the following:

• Thanks to GM cotton, thousands of tons of insecticide have not been sprayed in fields, and fewer farm workers are poisoned by insecticides.
• Of the 8.5 million farmers growing GM crops in 2005, 90% are in developing countries, yet European consumers try to dictate to them that they cannot use an environmentally benign GM method to control insects.
• Insect-resistant GM maize means that levels of dangerous mycotoxins in the human and domestic animal diet have been reduced.
• Golden rice which could contribute to alleviating vitamin A deficiency for millions is unnecessarily delayed.
The greens purport to oppose the power of multinationals, yet the onerous regulatory burden imposed by their posturing ensures that small companies can't compete with big companies to bring GM products to market. A startup company I co-founded in the US, now employing some 50 people, could not have been established in Britain because of investor worries about consumer reactions to GMOs.

Drought resistance, disease resistance and nutritional benefits, from developments already available or in the pipeline, are being delayed throughout the world.

Nobody counts the considerable cost of NOT expeditiously deploying GM crop improvements.

I have been making transgenic plants for over 20 years. It is the most benign, ecologically sound new method for crop improvement in a century. The more I do it, the less I worry about it. Provided simple and obvious regulatory precautions are taken, there are no plausible scenarios for the technology to cause serious damage. There are some known unknowns that can be tested in any new GM variety, but there are no unknown unknowns.

How did we get into this impasse? The opponents of the technology recklessly damage the public interest by ignoring some obvious truths.

First, agriculture is not "natural" any more than it is "natural" to talk to someone miles away on a mobile phone. For readers in London, a natural state would be for most of them to be reading this in a dense swampy oak forest; most readers would not like the "natural" state for long.

Converting wild areas to agriculture is about the most damaging thing we can do; we should maximise agricultural productivity in order to minimize the extent to which such conversion is required. Breeds of domestic animals and plants are all unnatural; consider the diversity of dogs, all descended from wolves. It is absurd to suggest that GM represents a quantum shift in unnaturalness.

Second, farmers have to solve practical problems. What is the least bad way to control weeds in their crops? Or insects, or diseases? Very few of those who lecture farmers on how to solve these problems without modern methods have any experience of doing so themselves. Hand-weeding millions of acres is not an option. Ploughing is damaging to the soil and promotes release of CO2 from agricultural land. If you're going to use herbicides, what is the least bad herbicide? It turns out that for cheapness, low mammalian toxicity, lack of persistence and lack of tendency to contaminate groundwater, glyphosate Roundup is hard to beat. The trouble is, it kills the crops. Solution? GM round-up ready crops. Those who think this is a bad way to control weeds have yet to propose a better alternative.

Third, with decreased affordability of oil, the competition between food and biofuels will intensify. A ton of grain requires a thousand tons of water; is it any wonder that China, which is experiencing water
shortages, is importing grain? We cannot afford to waste land and water by growing organic wheat with a 50% reduced yield compared to conventional.

Organic agriculture was originally envisaged as a cultural practice to nurture soil health. For organic farmers to rule out GM approaches to disease and pest resistance is irrational, a matter of doctrine rather than logic. The arguments about contamination are about imaginary hazards. It is as if a Protestant and a Roman Catholic church were next door to each other, and the Protestants objected to the smell of incense from the neighbouring church as "contamination". It boggles the mind that the "greens" are opposed to a late blight resistant potato developed with GM techniques when organic methods for blight control involving copper compounds are more toxic, environmentally damaging and less effective. David Miliband is right to call organic "a lifestyle choice" that is justified neither on reduced environmental impact nor food quality.

During the last century the human population increased four-fold and is expected to rise by another 50% to nine billion people. Humans already intercept about 30% of all terrestrial photosynthesis; for any species to be so greedy is unprecedented. We need to reduce our footprint on the earth; by increased use of renewable sources of energy, by minimizing the waste of water, by maximizing recycling and by controlling our population.

A GM blight-resistant potato will require less agrichemical applications, fewer tractor trips and less CO2 emissions. No damaging effects have been documented for GM crops or GM food. Never before have such expensive and onerous regulations been established in response to purely hypothetical anxieties. GM agriculture is part of the solution, not part of the problem.

The Accompanying Issues of Patents

Advances in Cotton Biotechnology are essential for the protection of innovation in biotechnology. While patents do not constrain research, they may seriously constrain the commercialization of biotech products, particularly by the public sector. Private public partnerships will often provide a realistic option.

A number of patents provide intellectual property rights (IPR) over various aspects of cotton transformation and regeneration, as well as the specific genes to be transferred. In contrast to some opinion which believes IPR stifles public research efforts, we suggest that published patents represent a wealth of new information.

Patenting does, however, seriously modify opportunities for commercialization of biotech products. Even in cases where a technology is novel and patented, it may be dependent on earlier developments with
broad regional patent coverage and so cannot be freely used even by the inventor.

While research with biotech cotton is being pursued vigorously in many public sector institutions, with the exception of China (Mainland), these efforts have not yet resulted in commercial releases. IPR, together with other financial and marketing possibilities, may complicate the commercialization of outcomes from public research programs. In this case private-public development agreements become realistic options, provided the legitimate aspirations of countries to access biotechnology are not stifled by excessive commercial aspirations of companies.

Pros and Cons re Intellectual Property Rights

WASHINGTON, DC - A panel of government representatives from key developing nations recently used the opportunity to highlight efforts at good stewardship of intellectual property rights and acknowledge a link between IP protection and economic development. But they also raised concerns about the application of the existing global IP system to their countries.

The 4 April panel in Washington, DC was sponsored by the Center for Strategic and International Studies (CSIS), a prominent Washington policy think tank expanding into IP issues in a way that appears to promote IP rights. CSIS’s James Lewis said intellectual property rights and economic development are often seen as opposing values. Yet after hearing the presentations of representatives from India, Brazil, and China, Lewis said he saw commonalities of approach.

Research has shown, said panel moderator Robert Shapiro, chairman of the economic consulting firm Sonecon and former US undersecretary of Commerce for economic affairs, that there is a “clear virtuous circle: countries that have strong IP protection encourage the importation of technologies to their countries and subsequently increase the rate of their own technological development,” said Shapiro “This is not abstract. Look at South Korea, China, and Taiwan.”

A common element was the seeming agreement of the three panellists with Shapiro’s view, as each panellist described the IP situation in their countries and the assertion that an effective system for IP protection appeared to be good for the country’s own economic development.

Yang Guohua, counsellor for intellectual property at the Chinese Embassy, commented that he had been told that the sizable audience would have been maybe 12 people five years ago. The interest in intellectual property is not limited to Washington, Guohua said. “If we held [the panel] in China we would have 400 attending. But then we have more people than you.” Guohua struck another common theme among the panelists in describing the relative newness of IP protection in his
country, saying the first patent law in China was passed 25 years ago, and the first copyright law 15 years ago.

“I see tremendous progress in IP enforcement [in China],” Guohua announced, “but still see many serious problems, which is why the government and the private sector have put more focus on IP protection.” In support of his claims, Guohua read from several documents. One was a state council paper from last year on the “promotion of innovation and self-promotion over the next 20 years.” A necessary co-objective for the same period, Guohua read, “is to build a complete legal system to combat counterfeiting and piracy so that the government can create an environment for the creation and transfer of intellectual property rights.”

The second document Guohua read from was the 2007 action plan for IP rights released the day before the event by the state council; among the 10 action items were legislation, enforcement, judicial protection, public awareness of IP rights, obtaining international cooperation, promoting IP protection to businesses, and providing service assistance to rights holders. A third document was a China Supreme Court opinion on how to increase the strength of IP rights. The paper called for more training for IP judges, the creation of IP tribunals, and for ways to publicise the judges’ rulings, such as the Internet. Guohua also read from a press release on a conference held in China last week that addressed the same topics. “This is what we are talking about in China,” Guohua said.

**Good Fences Make Good Neighbors?**

India’s patent law was passed just two years ago, said Anoop Mishra, economic minister for the Embassy of India. “In India today, IP is fully-TRIPS compliant,” referring to the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). The number of patent applications has grown 50 percent in the past five years, he noted. “We have also introduced an interesting new concept of pre-grant opposition to patents, which the filing companies don’t like, of course.”

Mishra described a number of emerging concerns, including public health issues in relation to patents. “There is a great debate involving the cost of medicines as we try to balance the rights of the innovators and of society,” he said. Mishra also noted the policy that “any patent regime should not obstruct or restrict free, economic competition. This will need to be addressed.”

In the interest of uniformity and harmonization, Mishra suggested that, since the United States is all but alone in its “first to invent” patent approach, it should consider that “first to file is better.” But Mishra said that IP protection has opened up “a great opportunity in the pharmaceutical sector in India, enabling an environment for global players to enter India.” While other countries have transferred technology through international agreements, Mishra noted that mergers and
acquisitions have had a more positive effect in India. Overall, Mishra said, “India recognises, as with real property, that ‘good fences make good neighbors,’” quoting an American proverb that the US poet Robert Frost refers to in his poem “Mending Wall.”

While stating that Brazil has fought strongly against IP piracy, Carlos Alfredo Lazary Teixeira, minister-counsellor for economic affairs at the Embassy of Brazil, said that “Brazil has been confronted with an anti-piracy focus that has often obscured the larger picture.” The country’s Instituto Nacional da Propriedade Industrial (National Industrial Property Institute) has expanded the number of employees in an effort to address the backlog in patent applications. The goal is to have doubled the number of patent decisions in two years. “We are strengthening our culture for IP.”

Teixeira also re-stated his country’s position that the IP system must include mechanisms for combating “biopiracy,” the misappropriation of genetic resources, traditional knowledge, and folklore (143). A proposal from Brazil and others to amend TRIPS to address this concern was submitted to the WTO in June 2006.

Shapiro noted that 20 years ago only 25 percent of the book value of the 150 largest U.S. companies lay in what banks used to call “intangible assets.” Today, it’s 66 percent. But because patents, for example, are ideas and intangible, once they are formulated they “can duplicated at almost no cost,” he said, concluding, “Returns from innovation require strict patent protection."

John T. Aquino (113) may be reached at info@ip-watch.ch

GOE Policies, Regulations, and Actions Affect Quality and Cost Issues

- Inadequate post harvest facilities
- costly transportation
- approval of varieties and pesticide
- tariffs and sales taxes
- high commercial financing costs
- inadequate technical and management skills

The details of each of these principal constraints are described in the following paragraphs.

Inadequate Post Harvest Facilities

Quality constraints include the lack of adequate post-harvest facilities, including cooling and packing sheds, refrigerated transport, and cold storage. Improvements have been made. Large growers and exporters are
establishing their own facilities and acquiring refrigerated trucks. The availability of refrigerated containers has increased significantly in recent years, and regulations have been changed to facilitate their use and movement at Alexandria port. A new cold store facility is being constructed at Cairo International Airport. However, increasing production and export volumes will require more investment in support facilities. Particular challenges will be faced in extending these facilities to small and medium-sized holders.

Costly Transportation

The costly transportation issue goes beyond the relatively simple, if unnecessarily costly, acquisition of additional refrigerated trucks. Egyptian law does not permit efficient use of non-Egyptian trucks, thereby increasing the cost and availability of refrigerated transportation. Roads are often rough, slowing down the speed or reducing the quality of shipments. Airports in Upper Egypt do not have cold storage facilities in which to hold perishable cargo awaiting shipment.

Approval of Varieties and Pesticides

Other quality factors include the approval of varieties and pesticide issues. GOE time requirements for the registration of imported varieties, although recently improved, still prevent rapid adoption of improved varieties by growers. This is especially crucial with regard to export products where Egyptian producers have to compete with other suppliers having less time-consuming registration requirements—for example, Morocco. The pesticide issue is of very immediate concern given the E.U.’s decisions in 2002 specifying, by name, the chemicals that are acceptable for use on fresh fruits and vegetables consumed in the European Union. The GOE’s recent adoption of a fast-track system, allowing approval of chemicals without proper documentation, has moved it away from earlier protocols that brought its regulation of pesticides more in line with international standards. It is especially worrisome that the fast-track approval system, may result in use of products that do not meet E.U. standards. Should imports from Egypt be found in violation of E.U. regulations, further imports will be endangered until producers come into compliance.

Tariffs and Sales Taxes

The principal GOE-imposed cost factors, other than income tax, relate to tariffs and sales taxes on imported equipment. For example, the tariff levied on imported refrigerated trucks and components remains at 45 percent despite Parliament’s 1998 action reducing it to 5 percent. There also are tariffs on other equipment and materials needed to improve the cold chain.

High Commercial Financing Costs
Commercial financing costs are high—commercial interest rates are 15 percent minimum. Small and medium-sized holders are also constrained by limitations on Principal Bank for Development and Agricultural Credit (PBDAC) financing and high rates of interest charged by other suppliers of credit.

**Inadequate Technical and Management Skills**

Export product growers and exporters need to improve their technical and management skills. They need to learn more about production, handling, shipping, and marketing quality products. All levels of management need to learn and implement effective general management techniques.

**Can Small and Medium Sized Farmers Contribute to the Export Market**

Present efforts for export markets have focused mainly on large-sized farmers, but future efforts should offer export markets to small and medium-sized holder farmers. Small and medium-sized holders, especially those who own their own land, spend a much greater portion of their increased income from horticultural export products in their villages than do corporate farms and absentee landlords, who purchase inputs in major cities or directly from foreign suppliers and do not leave the profit from their operations in rural villages. The risk to exporters in using small and medium-sized holders is that emerging quality assurance requirements, such as EUROGAP (147), will prove too costly or risky to justify working with smallholders, as is happening to some extent in the Kenyan fine green bean sector.

The principal constraints to continued development of Egypt’s emerging export sector in non-traditional crops relate to delivered product cost and quality. With total supply from Egypt and other countries increasing and Egypt increasing its market shares, delivered costs, insurance and freight (CIF) are becoming a significant issue. Increased supply and importer quality requirements also increase the need to produce and deliver product that meets buyer specifications.

**Opportunities for Growth in the Domestic Market**

Traditional fresh horticultural crops are grown primarily for the domestic market, normally sold in bulk, and have a low export-pricing structure. A strategy to maximize rural income, and hence rural employment generation and poverty alleviation, must focus on products grown by a large numbers of farmers, preferably beyond the subsistence farmer level. Desirable products should have high domestic demand and preferably some export demand to secure higher volume and prices, promote increased quality, and provide outlets for increased production.

They are grown primarily by small and medium-sized holders who know how to grow them; they are sold through existing marketing chains;
quality is not a major current issue; the crops respond to low-tech agronomic improvements; and the technology interventions to be learned and transferred by extension agents are relatively simple.

The most important traditional crops are tomato, which has the largest harvested area and greatest tonnage production; and potato and orange (including navel, Mandarin, Clementine, and nectarine), which have large cultivated area and production, and established export markets. Approximately 850,000 feddan of these products was harvested in 2000. Together, they are grown in every governorate. Yields are relatively low and can be improved through known low-technology, low-cost changes in cultural practices.

**Well Trained Extension Specialists Are a Must**

The farming practices employed for Egypt’s principal horticultural crops, grown by hundreds of thousands of small and medium-sized holders principally for domestic demand, can be improved and thereby increase rural income. Costs can be reduced, yields increased, and quality improved through the introduction of even low-technology, low-cost techniques. This has not been accomplished for three principal reasons:

- MALR does not have a sufficient number of well-trained horticulture extension advisers;
- MALR does not have horticulture technology packages for extension advisers to deliver to the farmer; and
- NGO efforts to provide horticulture extension are relatively small.

*Role of the Private Sector in Extension*

The success of any extension activity is absolutely dependent on its relation with the private sector and key government agencies to ensure that the technology being transferred effectively meets industry (private sector) needs and at the same time is sustainable on a continuing, long-term basis. The ultimate project goal should be to strengthen HEIA and other industry associations to the point where they can be empowered to substitute for government in playing the pivotal industry development role in addition to meeting their own organizational responsibilities.

In addition to the involvement of the Ministry of Agriculture and Land Reclamation (MALR) extension should develop a broad base of cooperation with all government entities involved in the export sector, such as the various components of the Ministry of Foreign Trade, the Ministry of Transportation and other relevant government agencies.
Special Problems for Small Farmers

Most smallholders have not adopted advances in agricultural practices that will lower cost of production and increase yields. Part of the reason for this is lack of financing for capital investments, such as drip irrigation and tunnels, and adequate or improved inputs, such as proper chemicals and certified potato seed. Even low-cost improvements (for example, proper watering, crop rotation, pruning of fruit trees, and reduction in pesticide applications) have not been adopted because the farmer either does not know about them because of the deficiencies in horticulture extension or cannot afford them.

Limits on Credit Availability for Smallholders

Credit availability and cost are major constraints faced by smallholders. Farmers who do not have registered title to their farmland cannot obtain the low-cost (7 percent) loans available from the Principal Bank for Development and Agricultural Credit PBDAC. Those who do have registered title may be restricted to loan amounts that are insufficient to finance inputs needed for optimal production. For example, the maximum PBDAC loan available for potato production is LE 2,992 per feddan. The cost of inputs to attain better-than-average yields (including imported seed) is closer to LE 4,500. An additional LE 1,000 for full fertigation will increase yields another 65 percent. The potato farmer then has a choice—use less than optimal levels of inputs or find another source of credit. Whatever credit cannot be raised from PBDAC or family resources comes from brokers, wholesaler agents, and input suppliers. These sources charge 1.5 percent or more per month. For some crops, PBDAC provides seeds as part of the loan. If these are lower-yield seeds than the farmer could purchase elsewhere, they effectively reduce income. Brokers and agents will also provide inputs, usually marking them up from their cost. They require part or all of the crop as payment, making no differentiation in price for the quality of the crop. The advantage of this system is that it requires virtually no liquidity on the part of the farmer. The disadvantage is that it increases the cost of production, resulting in lower revenue than would otherwise be received.

In addition to the low limits on PBDAC crop loans, there is a limit on the total amount of borrowings a farmer can obtain from PBDAC for farm improvements such as irrigation. For those who have registered title to their land, the maximum allowable is 50 percent of the total expenditure and the interest rate is higher—13-14 percent—than for crop loans.

These limitations may make it difficult for qualifying smallholders to purchase new technology that greatly increases yields—for example, drip irrigation, trellising, and row tunnels. Those without registered title to their farmlands usually have no source of credit to make such improvements.
Lack of Market Information Hurts Smallholders
Smallholders are also constrained by their lack of market information. Reliable price information about historical and current prices and market conditions is not widely available. Lack of information about last year’s crop prevents good planting decisions and choice of trader/wholesaler agent for the following year. Lack of information on current prices weakens the bargaining position of smallholders for farm-gate sales.

Water Pollution Hurts Everyone
Water pollution is a problem in the Delta, especially in areas near cities. Areas of particular concern are Kalubia, Beheira, and Alexandria, but large areas of the Delta have problems stemming from the dumping of raw sewage and garbage into the canal system. This raises domestic health issues and may also prevent Delta farmers from selling into European markets when EUROGAP quality provisions are implemented.

What does the Future Hold?
If USAID continues its current intervention in the export horticultural sector, the support will change the structure of Egypt’s horticultural exports in this decade. The changed sector will see higher rates of growth in exports powered by high-value, non-traditional exports that are less subject to the volume and price swings of Egypt’s traditional horticultural exports.

The amount of land and number of farmers required to produce non-traditional agricultural export (NTAE) are relatively small compared with Egypt’s more traditional crops that are oriented to the domestic market.

There is also a question as to how quality and cost-competitive small and medium-sized holders growers will be in the rapidly changing marketplace for NTAE.

The potential to increase small and medium-sized holder income, and hence rural job creation and income, is greater in traditional crops that are primarily oriented to the domestic market than in high-value export crops.

Attaining growth in income among small and medium-sized holder producers of traditional crops will require development of a low-technology, low-cost technology transfer packages and system based on sound market information and using the combined efforts of USAID-financed projects, effective producer associations and cooperatives, governourate MALR offices, NGOs, and private companies engaged in domestic and export marketing.

AERI is one vehicle that USAID and Egypt are using to bring horticultural crops up to their potential.
Horticultural Export Industry Association (HEIA)

HEIA is a trade association, originally spawned by ATUT. It is now a direct beneficiary of USAID funding. HEIA was formed at approximately the same time as the ATUT project got underway. This fortunate juxtaposition was an important element in the success of both ATUT and HEIA. Some 90 percent of ATUT clients were HEIA members. Without the technical assistance provided to its members as well as to HEIA as an organization, the Association could not have progressed nearly as rapidly as it has. In the absence of the ready-made client base provided by HEIA members, ATUT goals would have been much more difficult to accomplish.

During the past five years HEIA has made significant accomplishments in expanding its membership, in staff development, in technical support, training and other services provided to its members. It also succeeded in establishing the Refrigerated Perishables Terminal (RPT) at the Cairo Airport. The combination of all of these factors has contributed to the significant expansion of Egypt’s horticultural exports. HEIA expanded its membership by 76 percent between 2002 and 2004 and now has about 380 members. Most of the growth has been in the associate member category. Associates pay lower membership fees and have not had access to HEIA’s full range of services. A large number of seminars and workshops provided training on technical production and post harvest handling practices over the past five years. Training to attain compliance with international standards, particularly EUROGAP and BRC, has been an important part of the training program. HEIA’s system of arranging technical assistance visits by international horticultural specialists is widely credited for enabling members to implement the production and post harvest practices that are required for export. Members report that participation in observational study tours organized through HEIA was a very valuable source of learning and technology transfer.

Based on the evaluation team’s analysis it is clear that HEIA played an important role in expanding the export of the horticultural crops. A significant number of members we interviewed indicated that they would not have been able to venture into horticulture for export without HEIA. Some said they would not be able to continue without the services provided by the association.

It seems that the future of HEIA includes some significant organizational challenges. According to the review done by Development Associates, Inc. January 31, 2005, HEIA does not have a well developed cost accounting system, and its financial accounts do not permit an analysis of all of the individual services. Their analysis indicates that the revenues of most services fall far short of covering full direct costs and that overall, HEIA’s service revenues provide only some 25 – 30 percent of the direct costs of providing the service.
When the reviewers asked groups of members, what would be their reaction if HEIA is obliged to increase the current prices of its services by 100 percent, they felt disappointed and said that the demand for most services would decrease, particularly what is demanded by smaller growers. Others indicated that without services they could afford, they would be inclined to drop their membership.

HEIA’s staff has developed a draft budget to explore how the association will operate without grants to support it. According to the budget, most of the key service departments are expected to generate the revenues to cover their direct costs. The Team reported that HEIA still needs to do considerable additional work to devise a more realistic budget.

To the review team, it appears unlikely that HEIA will be able to provide some of the services that have proven to be very valuable, if their full direct costs are to be covered with user fees. Services in this category include foreign expert visits and overseas observational travel. It will also be difficult for many HEIA members to afford the cost of its own field consultants. There appear to be ample grounds for some form of continued USAID support to HEIA, and it appears that funds for such support already exist in the partner activities of AERI.

HEIA aims to expand its membership and services to Middle and Upper Egypt, and the association has already opened an office in Luxor. Experience with this office has demonstrated that it will be expensive for the association to expand and operate in the area. To effectively meet the needs of AERI clients and other smallholders in the area, HEIA’s services will have to be restructured to deal more with groups, and to overcome the logistic problems posed by farmers who may be illiterate or have limited access to transportation.

Even in a restructured form, it is unlikely that many smallholders would be able to bear the full cost of HEIA’s current services. Other critical issues that must be addressed include the improvement of transport facilities, development of a proper cold chain system, improving access to new planting materials, providing better extension services, and measures to develop and retain more semi-skilled and skilled workers.

Recommendations Made by the Review Team for HEIA

Hire a full-time Executive Director ASAP. Clarify in writing the differentiation of his/her roles from that of the Board.

It is advisable to have more Board members participate in board training. One product of the training would be a workable executive policy that all will commit to. This policy should focus on the Board’s role in formulating vision and strategy, with day-to-day operations left to the Executive Director.

Review the core business processes such as consultant visits from a process improvement point of view.
HEIA should develop explicit responsibilities and more efficient procedures for monitoring and evaluation as well as internal auditing.

HEIA should identify additional ways of informing firms of the HEIA advocacy efforts and providing venues and opportunity for member involvement in the advocacy process.

HEIA must go through each service that it offers to analyze existing and potential user demand, the prices that users would be able to pay, and HEIA’s cost of providing the service. It should also consider how costs might be reduced by re-structuring the way that services are offered.

In its analysis of alternatives, HEIA must give broader attention to membership expansion, especially among smallholders. This should include an evaluation of restructuring membership fees, perhaps through use of a sliding scale.

A full range of cost reduction alternatives must be considered. This will include restructuring services so that they may be offered at a lower cost and eliminating services that cannot be re-organized to cover their costs.

Decisions on HEIA’s proposed Luxor Terminal and other handling facilities in Middle and Upper Egypt remain to be considered by the association. The final decision on the Luxor Terminal should wait until it can be said that the Cairo Terminal has proven its financial viability.

**Summary of Comparative Advantages**

Egypt enjoys a significant comparative advantage in the production and export of high value horticultural products. This comparative advantage is based on a number of factors, including favorable agro-climatic conditions, physical proximity to important markets and counter-seasonal production capabilities. The growth in industry cohesiveness and sophistication and an increasing awareness on the part of government toward the importance of private sector primacy in decision-making are also important factors.

Despite the significant growth in exports that has already occurred, a small number of Egyptian horticultural products still command a minor market share in a relatively few export markets. This indicates significant potential for further increases in sales to current markets as well as for entry into new markets.

Any analysis of export potential for Egyptian high value horticultural products must also take into account the market opportunities for processed products. Another major opportunity for increasing horticultural exports is the rapid growth in world demand for organically and naturally grown foods. Egypt is very favorably situated to exploit these markets, particularly in those areas newly opened for cultivation, which have no history of agricultural chemicals application. While the focus is on exports, the Egyptian horticulture industry should not lose sight of the fact that there is also a growing demand for higher quality
foodstuffs in the domestic market, led by five-star hotels, up-market restaurants, fast food chains and an increasing number of supermarkets.

In order to fully capitalize on these opportunities, however, the Egyptian horticulture industry must overcome a number of policy, commercial and cultural constraints.

These constraints include:

- transport restrictions;
- regulations affecting easy access to new varieties, agricultural chemicals, fertilizers, transportation equipment, etc.;
- lack of linkages between research and extension and between producers and researchers;
- insufficient export volumes;
- lack of access to technology particularly on the part of small and medium-scale growers;
- ineffective horticultural extension services;
- the absence of post harvest facilities;
- inadequate market information and market intelligence systems and;
- some remaining elements of mistrust that still exist between the private sector and the government, among government agencies and within the private horticulture sector.

The growing shortage of semi-skilled and skilled workers at all levels of the industry also poses a serious constraint.

One of the most urgent of these specific problems is the impending imposition of the EUROGAP protocol being promulgated by major European retailers. This embodies food quality assurance measures combined with social and environmental responsibility standards. Failure to meet those standards will deny Egyptian horticultural products access to current European markets and will prevent entry into new EU markets.

**Evidence of Progress in Food Marketing**

**Food Export Council**

**Ministry of trade and industry**

*This article is a quote from: Business Today April 2006 (118)*

"New activity in the food processing industry fueled record industrial growth of 5.1% last year as companies tapped lucrative Gulf and European markets. Members of the new Food Export Council are convinced they can grow last year’s $500 million in exports to $3-4
billion within a decade. Here’s how. After serving as a brake on economic growth for the last 20 years, Egyptian industry is finally picking up speed. Last year, overall industrial growth clocked in at 5.1%, up from 3.5% in 2004, according to newly released figures from the Ministry of Trade and Industry (MTI). That surge has considerably narrowed the gap with GDP growth, which analysts expect will come in somewhere between 5.7% and 6.0% when the final 2005 figures come out some time later this month. New industrial jobs are finally being created, and industry is catching up with services and raw materials as a major driver of exports, as Egypt begins to shake off the legacy of a command economy, protectionist policies and an utter lack of national vision. With industry now at a crossroads, pessimists still argue that it lags too far behind the rest of the world to catch up in this generation, and economic nationalists continue to argue for import substitution. But while the early numbers are encouraging, signs that Egypt’s manufacturing base may be on the verge of a breakthrough transcend the hard data. Confidence, development economists have long argued, is an unquantifiable factor as important as performance in the early stages of a recovery, and a new generation of industrial leaders is increasingly optimistic that it can help catalyze economic growth. We recently caught a glimpse of how Egyptian industry is changing. Beyond the numbers and the wordy industrial strategies coming from government, we saw an example of how a long-dismissed sector can turn itself around and redefine the meaning of ‘business as usual’ in Egypt thanks to an injection of confidence at the right moment in the cycle. “With 117 new factories and LE 4 billion worth of new investments in 2004-05, processed food was one of our fastest growing industrial sectors and the best turnaround of the year,” says Helmy Abouleish, managing director of the MTI’s Industrial Modernization Center (IMC). The lion’s share of the expansion came from new Egyptian ventures, many of them funded by Gulf cash, although a statistical breakdown was unavailable at press time.

Food processors have adopted an ambitious export-led growth strategy — one dismissed by critics as too ambitious as recently as last fall — that could serve as a blueprint for other manufacturing sectors, blending highly targeted government assistance with private-sector know-how.

“Exports are the only way to turn industry into the angel of growth,” Abouleish says. “We cannot move from an industrial growth rate of under 3% to the 10% that we require without exporting. With a small domestic market, only exports can help us grow.”

According to Tarek Tawfik, managing director of vegetable processing giant Farm Frites (the largest single-company exporter of processed foods in 2005) and the head of the Food Export Council (FEC), Egypt’s
total processed food exports in 2004-2005 skyrocketed by 70% over the previous fiscal year. In 2001, Egypt barely squeaked out $100 million in processed food exports. By 2005, that figure topped $500 million. “It’s still a flimsy sum — far from where it should be,” says Tawfik, “but it’s nonetheless a significant increase. It shows that there is interest, and it was a real eye-opener for us. I think there was a snowball effect: All the changes that the sector and the country have undergone in the past few years — starting with the devaluation of the Egyptian pound, which brought with it new foreign and local investment — are finally beginning to show results.”

Tawfik also cites factors including financial support from the government in the form of export subsidies, legislative reforms, easier access to and use of industrial land and the overall facilitation of licensing procedures as having helped drive growth. We have seen several multinationals acquire local food companies in the past couple of years, and some have started using Egypt as a regional hub for their exports,” he says. To cite one high-profile example: Dairy foods giant Danone purchased 100% of Olait, a leading Egyptian maker of plain and fruit-flavored yogurts and desserts, last October for an undisclosed sum, giving it a local factory with 25,000 tons of annual capacity and a foothold in a market that consumes 110,000 tons of fresh dairy each year.

“Migrating industries are leaving the United States and Europe because they can no longer compete. As they’ve moved here, we have suddenly found ourselves exporting semi-commodities to Europe and the US. Egypt has now been identified as an alternative global supplier for many products based on the fact that we have a reasonable agricultural base.

Momentum is building,” says Tawfik. Could the days in which a ‘Made in Egypt’ tag was seen abroad as a warning label, not a selling point, be coming to an end? Just 20 companies account for 64% of the nation’s food exports. The Americana Group (owners of local joint ventures with multinationals including Heinz and Farm Frites) alone was responsible for LE 340 million in exports last year. Juhayna Group’s dairy and juice exports came in third at LE 142 million.

The two top single-company exporters were Farm Frites with LE 147 million and Greenland Dairy, which was acquired by Americana in 2004, with LE 134 million. Other large single-company exporters include Juhayna Juices (LE 121 million; its dairy division exported LE 21 million), Faragallah Juices (LE 116 million) and confectioner Cadbury (LE 104 million), according to FEC figures.

Mineral water exports grew by 183%, sales of olives climbed 125%, while frozen vegetables climbed 56%, dairy 45%, olive oil 40% and juice
17%. Dairy, juices and concentrates and confectionery were the top-three processed food exports by chapter last year.

“Some of our largest export markets for processed food are regional,” says Tawfik. “Interestingly enough, Libya is one of the largest purchasers of our dairy products, while Saudi Arabia is a large market for both dairy and juices.” Regional markets are barrier-free and do not demand changes in unit sizes or labeling language.

According to MTI figures, Egypt sold European Union nations LE 515 million worth of processed foods in 2005, a 37% increase over the previous year, making it the largest non-Arab market. Egyptian food processors already enjoy a reasonably good reputation in the EU, having been helped along by projects including the USAID-funded Agriculture Led Export Business Program and previous incarnations of the IMC, both of which focused heavily on European markets.

A meager LE 1.3 million went to the United States under the new Qualified Industrial Zones (QIZ) protocol from only two companies: Farm Frites (frozen vegetables) and Kato Group (herbs and spices). “The US was never really in the picture for us before, but that is starting to change. It will take time to develop our market there, so it is really unfair to measure the effect of the QIZ on the food sector for the time being.”

“In the food business, cultivating a market is a very long process,” he continues. “You have to produce the right agricultural varieties and then go into trials before you even become qualified. It requires both time and investment. So right now, we are not even on the map when it comes to the US. Next year, I think we [the industry] can probably hit somewhere between LE 13-20 million, and by 2007 maybe we can double that figure,” adds Tawfik.

Last year may have broken records, but 2005-06 looks even more promising. According to IMC and FEC figures, the processed food sector has already achieved 219% of its export target for the first seven months of the year, which started in July 2005 and ends in June. Growth should increase later this year as new production capacity comes on stream: During the last two months alone, 149 new processed foods factories have been established.

“Not only has food been a fantastic turnaround, but there will be huge potential for the sector as the new investments start to mature and contribute positively to export figures,” says Minister of Trade and Industry Rachid Mohamed Rachid. “They have one of the best managed export councils run by some of the most outstanding, experienced and dedicated businesspeople in the country.”
Rachid says that while the government has given strong support to the sector over the last couple of years, a more important factor in its success is that “people [in the industry] have started getting their acts together.” “We gave them some strict conditions, like sticking to very stringent quality standards and approvals, without which they would not get our support,” the minister says. “For the first time, this put some serious pressure on the companies to conform to worldwide quality standards. But in essence, they are the ones who have made it happen, they brought about the turnaround.”

In the Export council, like all manufacturing sectors, processed food has its own council to liaise between the private sector and the government. These were first launched as commodities councils in 1997 by former Minister of Supply and Provisions Ahmed Guweily; last year, Rachid ordered them transformed into export councils. According to the business leaders involved with the new councils, the change has been more than cosmetic.

At a recent meeting of the FEC at Edita’s Sixth of October City factory, it was clear that its members were not merely there to network or put on a show for Rachid. Armed with PowerPoint presentations and hard data, they ran a concise, informative and well-planned meeting in which they briefed the minister on the latest developments in their sector, highlighting both strengths and weaknesses. In the course of the meeting, Rachid struck an impromptu agreement that will see the Netherlands’ Quest, a leading international producer of flavors, fragrances and additives that recently opened a factory in Cairo, join the National Supplier Development Program to help solve local sourcing problems it has been facing, particularly in the acquisition of dried onion.

“The councils have changed from being committees for policy advocacy to real export advisory boards,” says Tawfik, who has chaired the FEC for three consecutive terms, predating Rachid. “The new councils are all made up of volunteers who represent the various subsectors. In food we have at least 13 subsectors. Since last year, our function has changed in a very positive sense. For instance, we are deeply engaged with the government right now in preparation for negotiation files for various free trade agreements. This private-sector perspective combined with the government’s technical experience has led to a very positive partnership,” says Tawfik.

Last year’s signing of the QIZ agreement caught many producers off guard. There was widespread confusion concerning what, exactly, could constitute the required 11.7% Israeli component of the local manufacturing process. Industry leaders were more closely involved with
the technical details of the FTA negotiations conducted with the US and Turkey in the fall of 2005.

“This way you are not suddenly faced with an FTA that you know nothing about. Instead, you understand what’s coming and can therefore plan for and make proper use of it. We are being educated and contributing at the same time, and it’s all in the best interest of the industry,” he adds.

According to Rachid, “The Food Export Council was the first to come up with a very clear program regarding data analysis with a system that has really set a precedent and helped them to build effective strategies and policies that are now starting to pay off.” For the first time, the export council can provide its members with weekly, near-real-time data on production and exports by company, subsector, sector, country and region. “This has given us a lot of insight into the decision making process,” says Tawfik. “Of course it is still very basic data, but as basic as it is, we never had it before, so it is a big step forward.”

The FEC is also looking into how Egyptian exporters can make better use of the time they spend at international food fairs and exhibitions. Randomly choosing those to attend, with basic booths and mid-level representatives handing out business cards, is no longer seen as a productive strategy.

“Instead, we want these attendees to go and meet with the major multinationals and their business development managers,” says Tawfik. “We want them to be able to give presentations on Egypt’s competitive advantage. They don’t necessarily have to come back with contracts, but we want to create awareness of our industry abroad.

“While we may see that we have an edge in certain industries, the reality is that we are not even on the agenda of most multinationals — they don’t even know that we exist. So just highlighting some of the strong points of the economy and the facilities in the country would be an eye-opener.”

Quality control has never been Egypt’s forte, to say the least. Across all sectors, industry’s failure to meet international quality standards has been one of the biggest obstacles to the penetration of foreign markets. Manufacturers in all sectors have repeatedly identified the need for qualified technology centers close to home to deliver technical expertise they are unable to import on their own. Past attempts to establish technology centers have been legion, and most have proven ineffective. Last year, the Ministry of Foreign Trade and Industry began overhauling its existing centers and establishing new ones. There are now a total of
13, ten of them sectoral and three cutting across industry lines for packaging, clean production and total productivity management. All of them are adopting proactive, client-centered business models.

“The idea is to offer Egyptian industry the latest technology. We are still far from the innovation stage; in our current stage of development, technology transfer is vital,” says Abouleish. “The concept for all these centers is very clear. They are stakeholder-managed and rely on international expertise.

“We are currently investing a lot of money in this area in the hope that quality systems will move,” he adds, stopping short of saying how much, exactly, he has budgeted. The technology centers will be supported and financed by the government until they are strong enough to spin off as self-sufficient corporations operating at least on a cost-recovery basis.

“Once they start offering services and recording revenues, the government will pull out completely,” says Hany Barakat, a PhD management guru and first undersecretary at the Ministry of Trade and Industry responsible for the technology centers. “The new management model is based on a private-public partnership and has brought about very encouraging results thus far,” he adds, noting that the textiles and plastics tech centers have already broken even and are now offering their services to over 500 companies.

Late last year, MTI formed a new steering committee to restructure the Food Technology Center (FTC) and reposition it to cater to the needs of subsectors including meat processing, confectionery, baked goods, edible oils, fruits and vegetables, and dairy. Among the committee’s members are industry leaders such as Hani Berzi, chairman and CEO of Edita, the company that makes popular snack foods including Bake Rolls, Molto and Hostess Snack Cakes at two factories, one each in Sixth of October and Tenth of Ramadan.

“What was missing with the FTC before was the private-sector mentality. Previously, no one in the industry knew of or used the FTC. Now, we are the ones trying to make it all come together,” says Berzi, who pegs his exports at $4 million per year despite his products short shelf-lives. “As a manufacturer of food, I personally need the technical support that a center like this can offer” on issues including best practices and foreign quality standards.

In January, members of the FTC’s steering committee went on an MTI-financed study tour of Europe to visit similar food technology centers in Spain, Germany and Denmark. The outcome was what they call a
‘dynamic model’ for the Egyptian FTC that will see it adapt to the changing needs of the sector.

“The FTC will be run as a demand-driven private business in every sense of the word,” Berzi says, “with the overall objective of helping the Egyptian food industry develop into world-class exporters. We will tackle issues like accreditation, hygiene, food safety, technical assistance, testing and professional training.”

“We want the FTC to become a one-stop shop for the entire industry,” says FTC steering committee member Nada Khadr, who is also senior purchasing and quality assurance manager for McDonald’s Egypt. Khadr says McDonald’s Egypt currently works with 70 key finished-goods suppliers, with 90% of their total purchase basket now coming from local companies.

“Whether it’s quality, food safety, or manufacturing systems, McDonald’s has very strict standards,” says Khadr. “As McDonald’s, it is in my best interest to see the local food sector develop itself. We sometimes go and do factory checks on our suppliers and potential suppliers who claim that they are HACCP [Hazard Analysis Critical Control Points, currently one of the most popular accreditation programs in the food industry] certified, for example, and we find that they are not. It would save a lot of time and effort if we had a body like the FTC that could coordinate all these activities. Everyone from small factories to large exporters who want to upgrade could come to the FTC. We would do the matchmaking and tailor the training to meet their needs,” she adds.

The FTC has just hired a new European managing director whose mandate will, in part, be to assess the center’s current resources and create a pool of technical advisors. “Once he gets a full understanding of market demand, he will work closely with the steering committee to drive the business development of the center,” says Khadr. “Right now, we are also in the process of working out a budget and an organizational chart. We need to have very specific, measurable targets that can be reviewed — and our new managing director will be held accountable for these targets. “We want to give the FTC a business flavor and let people know that we are serious about our services,” adds Khadr, who is adamant that the center will not replicate the “ineffective foreign-expert syndrome” that has seen critics dismiss the technology centers in the past.

According to Berzi, the FTC will be integrating some of its services with other arms of MTI (including the IMC) that currently offer companies some of the same support the center will be selling, including accreditation and technical support. The FTC’s steering committee is
aware of the overlap, but claim “massive demand” for services and the high-quality of expertise the FTC will be providing will put it on a profitable footing. “Any redundancy in the services we provide will eventually be phased out as all food-related technical assistance gradually falls under the umbrella of the FTC,” says Khadr. Berzi says the center should be fully operational by May.

“The way that the stakeholders are approaching both the export council and the FTC indicates that there will be more good news coming out of the food sector,” Rachid suggests. “What’s really impressive is that the effort that the various companies have put in is not only for their individual benefit, but for the benefit of the industry as a whole. “People used to say that there is no teamwork in this country,” the minister continues. “To see a group of companies come together like this for the first time for the welfare of an industry is very encouraging. While the initiatives are being taken by representatives of our larger food manufacturers they are not the ones who need the services the most. It’s the small- and medium-sized companies that are really going to benefit from what they are trying to create.”

“Everyone has to carry his own weight”

According to Tawfik, the processed food sector has the capacity to export something in the range of $3-4 billion per year, an ambitious goal in light of today’s $500 million figure. But he and others on the export council are convinced they can make it happen.” Tawfik says. “Everyone has to carry his own weight — we can’t always have to look to the government to bail us out. There are lots of things that we can do collectively on our own behalves. Of course it will take time and a lot of personal commitment to change the image of Egyptian exports and really see our sector become world-class, but I see that the community spirit — at least in our council — is a huge step in the right direction.”


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About the Author

Lowell Nelson Lewis is a Professor and Officer Emeritus of the University of California and the coordinator of California/Catalunya Programs. His association with agriculture has been a lifetime relationship which began on his family’s Pennsylvania farm, continued through an academic career in the University of California and a practical education about the agricultural and environmental issues of California.

Egypt became a part of his life about 1962 when Egyptian graduate students began coming to the University of California. In 1976 he went to Egypt for the first time with a team of academic faculty to work together on the “new crops” project. During the next decade he interacted through numerous studies on the economy and quality of life with the BOSTID committee of the US National Academy of Science.

From 1977 to 1986, the University of California through the Davis campus worked with USAID on a project on the improvement of the horticultural crops in Egypt. From 1985 to 1993, he participated in the Consortium for International Development which managed the USAID funded National Agricultural Research Project (NARP).

In January of 1992, he accepted the position of Senior Research Administrative Advisor of the NARP. This project spent over $200 million in an effort to increase food production and to improve Egypt’s economic competitiveness through an improved agricultural research and extension system. Improvement was accomplished through the renovation of facilities, technical and academic training, equipping laboratories and conducting research. His principal responsibility was to assist in the communication between the Ministry of Agriculture of Egypt and the United States Agency for International Development. During the last decade he has continued to interact with Egyptian colleagues and programs through various Mediterranean programs, the Rosenberg water foundation and ICARDA.